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PROGRAM

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Canada

DATA ON THE ABUNDANCE AND DISTRIBUTION OF RADON AROUND URANIUM TAILINGS PILES IN THE VICINITY OF ELLIOT LAKE, ONTARIO

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The results of a One Year Field Monitoring Program prepared for:

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EXECUTIVE SUMMARY

Monthly radon level measurements were made over the period of June 1984 to June 1985 to provide a data base for the atmospheric dispersion modelling of radon from uranium mine tailings piles at Elliot Lake, Ontario. The study was carried out as part of the National Uranium Tailings Program sponsored by Energy, Mines and Resources Canada. An array of sixty-three specially designed electrostatically enhanced solid state track detectors were used to make the measurements in the vicinity of the Crotch, Denison, Nordic, Quirke and Stanrock tailings areas, at three sites within the Town of Elliot Lake and at three background sites. The detectors featured an automatic capacity charging device powered with conventional 9 volt dry cell batteries. The electrostatic enhancement system provided the sensitivity and reliability required to measure low ambient radon levels during the monthly periods. Radon levels were also measured at 4 heights (1m, 2m, 4m, 8m) above the surface of tailings at two sites.

Meteorological instrumentation was installed at the Quirke and Nordic tailings areas to measure wind speed and direction, while a third station in the Town of Elliot Lake was established to measure temperature, precipitation, barometric pressure and relative humidity.

The principal conclusion of this study is that ambient levels of radon are quite low, even directly over uranium tailings, and that ambient levels drop rapidly to background with increasing distance from tailings. The results of the radon with height measurement program also show a decrease in ambient radon concentrations with increasing height above the surface of tailings.

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NOTICE

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1.0 INTRODUCTION

1.1 Study Scope

As part of its research program to study and predict the effects on the environment of uranium mine tailings, the National Uranium Tailings Program (NUTP) commissioned SENES Consultants Limited in association with the Canadian Institute for Radiation Safety (CAIRS) and R.A.D. Service and Instrument Ltd. in January 1984 to carry out a study to provide sufficient data to enable the staff of the NUTP to model the dispersion of radon in the atmosphere by providing reliable data on the distribution of radon in the vicinity of uranium tailings piles.

The study involved the design, implementation and operation of a network of 60 radon monitors deployed around five uranium mining tailings areas in the vicinity of Elliot Lake, Ontario.

A small network of three monitors was also deployed in three areas distant from the Elliot Lake tailings areas to serve as controls or background sites.

The radon monitoring program was initiated in June 1984 and continued until June 1985. In addition to the radon measurements the meteorological parameters of wind speed, wind direction were measured at two tailings areas while the parameters of temperature, relative humidity, barometric pressure and precipitation were measured at a site within the town of Elliot Lake.

This report presents the results of this monitoring program.

1.2 Report Outline

The remainder of the report has been divided into the following chapters:

Chapter 2. **Existing Ambient Radon Data** - discusses the major radon monitoring programs currently underway or completed over the past

10 years in the Elliot Lake Area.

Chapter 3. **Monitoring Program Design** - presents the rationale for the design of the monitoring network implemented.

Chapter 4. **Monitoring Equipment** - describes the monitoring equipment and methodology used in the analysis of the samples.

Chapter 5. **Meteorological Results** - presents the met data collected at the two tailings areas and the town site.

Chapter 6. **Radon Monitoring Results** - presents the radon data collected at the 60 tailings area sites and the 3 background sites.

Chapter 7. **Discussion of Results** - presents an overall review and discussion of the radon results for the off-tailings, on-tailings, background and Elliot Lake sites.

Data Sheets. Summary Statistics, sampling results and monitor performance for each site.

Appendix A. **Outdoor Concentration of Radon Daughters** - collected in the Elliot Lake Area by the Ontario Ministry of Labour during 1979-1981.

2.0 EXISTING AMBIENT RADON DATA

Over the past 10 years measurements of ambient radon levels in the Elliot Lake area have been carried out on a somewhat limited basis. The concern with radon and its daughter products has focussed more on the monitoring of underground and indoor residential levels than on outdoor ambient levels. Although much effort has been spent on the characterization of outdoor sources of radon (i.e mine exhausts, mill operations, tailings areas, etc.) little effort has been directed to the long term monitoring of outdoor radon levels.

This chapter outlines the major ambient radon sampling programs that have been carried out in the Elliot Lake area and presents a summary of some of the more pertinent data. To avoid confusion in the following discussions, the current radon monitoring program will be referred to as the SENES program.

2.1 Uranium Mines Expansion - 1977

The most detailed sampling and measurement program prior to the SENES program was conducted during 1977 as part of the environmental assessment of the proposed Elliot Lake uranium mines expansion. The program consisted of a number of radon and radon daughter measurements both on and in the vicinity of six Elliot Lake tailings areas. The samples were collected on 'grab sample' and 1 hour 'integrated sample' bases, at a height of 0.3 m (1 ft) above the ground. The grab samples were collected directly in scintillation flasks whereas the integrated samples were collected in tedlar bags over a 1 hour period before introduction into scintillation cells.

The results of this sampling program are summarized on Table 2.1. The '**near tailings**' samples were collected within 90 m (300 ft) of the edge of the tailings while the '**over tailings**' samples were, as the name indicates, collected directly over the tailings at a height of 0.3 m from the surface of the ground.

The radon levels of the **over tailings** samples ranged from a low of 0.01 Bq/L

Table 2.1

Ambient Radon Measurements - 1977

Tailings Area	Description	Number of Samples	Range Bq/L (pCi/L)	Average Bq/L (pCi/L)
Crotch*	over tailings	14	0.02-0.18 (0.6-4.8)	0.09 (2.5)
	near tailings	2	0.01-0.015 (0.3-0.4)	0.01 (0.4)
Nordic*	over tailings	4	0.08-0.34 (2.2-9.3)	0.17 (4.5)
Nordic*	vegetated tailings	1	-	0.06 (1.6)
Stanrock*	over tailings	4	0.01-0.04 (0.3-1.2)	0.02 (0.6)
	near tailings	3	0.005-0.02 (0.1-0.5)	0.01 (0.3)
Quirke**	over tailings	12	0.09-0.23 (2.3-6.1)	0.14 (3.9)
	near tailings	4	n.d.-0.02 (n.d.-0.5)	0.01 (0.2)
Quirke**	soil covered tailings	1	-	0.09 (2.4)
Long Lake**	over tailings	7	0.01-0.14 (0.3-3.7)	0.06 (1.6)
	near tailings	4	0.005-0.03 (0.1-0.7)	0.01 (0.4)
Williams Lake*	vegetated tailings	1	-	n.d.

Notes

* non-operating tailings
** operating tailings
n.d. denotes not detectable

Source: MacLaren 1978

(0.3 pCi/L) for the Stanrock tailings to a high of 0.34 Bq/L (9.3 pCi/L) for the Nordic tailings. For the **near tailings** samples the radon levels ranged from non-detectable to a high of 0.03 Bq/L (0.7 pCi/L).

As noted previously, radon daughter measurements were also taken as part of this 1977 monitoring program. These measurements were taken at locations similar to those at which radon gas measurements were made. The samples were collected on a grab sample basis with the extremely low results (shown in Table 2.2) representing order of magnitude estimates (MacLaren 1978).

2.2 CANMET Study - 1983

A study of radon gas concentration, surface radon flux and other radiation variables was conducted by Bigu et al (1984) as part of a research program at Stanrock tailings aimed at investigating long-term trends in radon gas exhalation from local uranium tailings piles. Although a substantial amount of data was collected during this study, no ambient radon measurements above the surface of the tailings were made. The actual radon measurements were made at depths of 0.2 to 6.0 m beneath the surface of the tailings.

2.3 DSMA ATCON Limited - 1985

The radon emanation rates from vegetated and unvegetated areas of the Nordic Tailings site were measured during the growing season from June to September 1984. The project was conducted on behalf of the National Uranium Tailings Program under contract number OSQ83-00273. The objective of the project was to measure and evaluate the effect of vegetation on the emanation rate of radon from a uranium tailings pile. The radon emanation from the tailings was estimated using the aerodynamic method developed at Guelph University. The results of the study indicate that there was no significant difference between the radon emanation rates from vegetated or unvegetated uranium tailings (DSMA, 1985).

For comparison, emanation rates were measured on both vegetated and

Table 2.2

Ambient Radon Daughter Measurements - 1977

Tailings Area	Description	Number of Samples	Range WL	Average WL
Crotch*	over tailings	6	0.0003 - 0.0015	0.0009
	near tailings	8	0.0004 - 0.0008	0.0006
Nordic*	over tailings	3	0.0003 - 0.0008	0.0005
	over vegetated tailings	1	-	0.0004
Quirke**	over tailings	4	0.0003 - 0.0008	0.0005
	near tailings	4	0.0002 - 0.0006	0.0004
	over soil covered tailings	1	-	0.0008
Long Lake**	over tailings	6	0.0003 - 0.0009	0.0006
	near tailings	7	0.0002 - 0.0014	0.0007

Notes

*	non-operating tailings
**	operating tailings

Source: MacLaren 1978

unvegetated areas using the accumulator technique. The accumulator measurements indicated that radon emanation rates from unvegetated areas was higher than from vegetated areas, however, the difference was attributed to the difficulty of sealing the accumulators to the soil surface through the matted vegetation cover (DSMA, 1985).

Although the report contains a considerable amount of radon exhalation data, no data for ambient radon concentrations are presented.

2.4 Mining Companies

Since 1976 the mining companies have carried out several studies to assess and characterize their many sources of radon which contribute to the overall ambient outdoor radon concentration. Table 2.3 presents a summary of the air emission information relating to radon activity for the Denison and Rio Algom operations. These data were presented in the Background Information document prepared by James F. MacLaren Limited (Volume 1, 1977) for the environmental assessment of the proposed Elliot Lake uranium mines expansion.

In May of 1976 Rio Algom took radon and radon daughter measurements at the Nordic tailings area, the downwind area generally south of the tailings area, and Nordic trailer park. The radon levels averaged 0.67 Bq/L (18 pCi/L) in the southern area, 0.44 Bq/L (12 pCi/L) on the tailings area and 0.13 Bq/L (3.5 pCi/L) at the trailer park. The radon daughter concentrations ranged from 0.003 to 0.011 WL both in the southern area and on the tailings while the concentration at the trailer park ranged from 0 to 0.02 WL (MacLaren 1977).

A series of samples were collected across the Nordic-Lacnor tailings and Quirke tailings areas in September 1976. The results, presented in Table 2.4, are based on grab samples.

2.5 Ontario Ministry of Labour

The Ontario Ministry of Labour (MOL) has carried out a radon-daughter

Table 2.3

Air Emission Information

		Radon Emission	
Company	Source	MBq/s	(uCi/s)
Denison	Mine Ventilation - Can-Met	2.1	(55.6)
	" " - Knowles Island	4.1	(112.0)
	- Punky Island	7.0	(189.0)
	Crushing & Grinding	0.4	(10.1)
	Concentrating (Mills)	0.4	(10.0)
	Tailings Area - Denison	6.6	(179)
	- Stanrock & Can Met	8.1	(218)
Rio Algom	Mine Ventilation - West	0.5	(12.3)
	- One East	0.9	(24.1)
	- Three East	0.3	(8.2)
	- Shaft	<0.3	(<8.6)
	Crushing & Grinding	0.3	(7.8)
	Milling & Concentrating	0.3	(7.8)
	Tailings Area - Lacnor	3.7	(100)
	Nordic	16.4	(444)
	Panel	5.9	(158)
	Quirke	24.7	(667)
	Spanish American	3.1	(84)
	Stanleigh & Milliken	5.1	(137)

* Source: Tables 9.5, 9.6, 9.7 MacLaren 1977

Table 2.4*

Rio Algom Tailings Area Radon/Radon Daughter Sampling - 1976

Tailings	Location	Radon Bq/L (pCi/L)	Radon Daughters (WL)
Nordic-Lacnor	Upwind	0 (0)	0-0.002
	Over the Tailings	0.26-0.44 (7-12)	0.005-0.015
	Downwind	0-0.22 (0-6)	0-0.008
Quirke	Upwind	0 (0)	0
	Over the Tailings	0-0.59 (0-16)	0.002-0.004
	Downwind	0 (0)	0.002-0.008

* Source MacLaren 1977

monitoring program in the Elliot Lake area, on behalf of the Ontario Ministry of the Environment (MOE) since June 1979. The development of this program was as a direct result of the recommendations of the Environmental Assessment Board Inquiry regarding the Elliot Lake expansion. The monitoring has been conducted using radon-daughter integrating samplers located at a number of stations throughout the Elliot Lake area. Historical data for the period 1979 to 1981 from four stations in the Elliot Lake area are presented in Appendix A.

It was the intent of the SENES radon monitoring study to co-site some of the radon monitors with the MOL radon-daughters monitors to assess any potential relationships. Unfortunately at the time of the installation of SENES radon monitors the MOL and MOE reassessed their monitoring program in the Elliot Lake area and removed a number of their radon-daughter stations. As a result it was only possible to locate radon monitors at three of the remaining MOL stations, specifically at the Municipal building in Elliot Lake, Porridge Lake pumping station, and at the Quirke Townsite.

The MOL radon daughter levels measured at three stations during the SENES radon monitoring period are presented and discussed in Section 6.9.

3.0 MONITORING PROGRAM DESIGN

The design of the radon monitoring program was based on a number of criteria as specified in the statement of work, combined with physical restrictions, site conditions and year-round accessibility. The following discussion outlines these criteria and the resulting program design.

3.1 Areas to be Monitored

In the Statement of Work for the contract the Quirke, Long Lake, Stanrock, Crotch Lake and Nordic tailings were specified as areas which the design should encompass. Following receipt of permission from Denison Mines Limited and Rio Algom Limited a tentative spatial arrangement of monitors around each of these five tailings areas was drawn up. This tentative arrangement was initially based on a distribution of eight monitors per tailings area, to be located at each of the eight principal points of the compass as described in the Uranium Tailings Sampling Manual (Golder Associates and SENES Consultants, 1985). The physical sizes and layouts of the tailings however, were not conducive to such an ideal layout and the initial design was revised. This revised layout took into consideration a number of factors which are described below.

With respect to other areas to be monitored the statement of work stated that the design must include an appropriate scheme to monitor background levels in areas unaffected by uranium tailings. To accomplish this objective three background sites were selected as follows: one at Mississaugi Provincial Park (25 km north of Elliot Lake); the second at Blind River Hospital, to be co-sited with Eldorado Resources Limited Terradex radon monitor (30 km south west of Elliot Lake); and the third at Atomic Energy of Canada Limited's East Bull research facility (30 km east of Elliot Lake). During the second half of the monitoring phase this third background site was moved to the intersection of Hwy 17 and 108 (24 km south of Elliot Lake) when access to the East Bull site was no longer possible.

3.2 Duration of Study

The statement of work stated that the seasonal aspects of radon evolution were to be accounted for. To accomplish this the monitoring program was operated for an entire year (June 1984 to June 1985).

3.3 Exposure Periods

To obtain as much reliable data as possible during this study the exposure period was tentatively set at 30 days or 1 month. However because of weather conditions, accessibility restrictions and manpower requirements the 1 month exposure periods could not be strictly adhered to. Over the course of the study the mean exposure period for all the stations was 36.6 days with a range from as short as 22 days to as long as 72 days.

3.4 Habitation Considerations

The existing and potential future habitation patterns were to be accounted for in this study. To complete this task discussions were held with Mr. R.D. Pigeau, Chief Building Official for the Corporation of the Town of Elliot Lake.

In simple terms, Mr. Pigeau related that Elliot lake is not likely to expand to any great extent, for the next 20 years or more. The decrease in the price of uranium over the past few years has had a direct impact on both the labour and housing markets in Elliot Lake. This decrease in the mining work force requirement combined with the construction of 1500 new dwelling units during the period of 1981-1983 (Nordic & Porridge Developments) has resulted in plentiful housing in Elliot Lake. In fact, the town is overdeveloped and unlikely to undergo any major expansion for at least the next 20 years (Pigeau 1984).

Although some minor expansions (80-100 units) have been outlined by local developers, these would be confined to within the existing limits of the town proper.

In terms of areas outside the town of Elliot Lake proper, development in the Dunlop Lake cottage area is under the control of the Ministry of Natural Resources, and only a few lots are available. One area where future development might have taken place was the Stollery Lake Trailer Park, however, the park was closed in 1983 with the residents forced to find alternate trailer space. It is unlikely that development will ever take place in this area again since Denison has removed all the services from the park (i.e. sewer, water, electrical).

Therefore in the design of the monitoring program the present limits of the Town of Elliot Lake were considered to be the future extent of the habitation for the area. On this basis three monitors were located within the town itself. In addition monitors were also installed at the existing Nordic and Quirke townsites.

3.5 Meteorology

Meteorological data are collected on an hourly basis at the Elliot Lake airport. The met station is operated by Norontair as a Private Aviation Weather Reporting Station (PAWRS) with measurements of barometric pressure, dry bulb and wet bulb temperatures, sky cover, visibility, windspeed and direction recorded for approximately 16-18 hours a day. The data are reported to weather forecasting stations and subsequently archived with no abstraction. Archived data are stored at the Office of Environment Canada in Toronto and at the Elliot Lake airport.

To provide continuous data on a micro-meteorological scale for wind speed and direction, a (10 m tower with aerovane was installed on both the Quirke and Nordic tailings. These locations were selected as the northern and southern extremes of the study area. Because of the expense in terms of the capital investment, operation of the equipment and abstraction of data, only two sites were considered economically feasible.

Because the meteorological parameters of temperature, relative humidity, barometric pressure and precipitation do not vary on a micro-meteorological scale between tailings areas as much as wind speed and direction, instrumentation to measure these four parameters was installed at one central location, specifically on the roof of the CAIRS office in Elliot Lake.

3.6 Radon Distribution With Height

To examine the distribution of radon with height, as specified in the statement of work, the 10 metre meteorological towers at Quirke and Nordic were outfitted with radon monitors. The monitors were installed at heights of 1m, 2m, 4m and 8m above the surface of the tailings. The Quirke site was selected to represent a non-vegetated tailings area while the Nordic site was selected to represent a vegetated tailings area. These tower monitors were generally operated on the same sampling basis as the monitors surrounding the actual tailings area.

3.7 Ontario Ministry of Labour Stations

The Ontario Ministry of Labour has operated a network of radon daughter samplers in the Elliot Lake area since June 1979. Section 2.3 of this report provides details of this program.

To comply with the statement of work, an attempt was made to correlate MOL radon daughter measurements with SENES radon measurements. At three MOL stations (Quirke Townsite, Porridge Lake Pumphouse, and Elliot Lake Municipal Office) radon monitors were installed alongside the existing radon daughter samplers. Both SENES monitors and MOL samplers were in operation throughout the study period.

3.8 Mine Ventilation

The statement of work indicated that an allowance for radon from mine ventilation was to be made in the design of the monitoring network. To accommodate this request the locations of the various mine ventilation exhausts were identified by the two mining companies and were taken into consideration during the monitor site selection process. Because of the limitation on the number of radon monitors available to the study, the mine exhausts could not be directly monitored, however several radon monitors were placed in the general vicinity of mine exhausts.

3.9 Final Network Design

The final network design is presented on Figure 3.1. The monitor locations are denoted by a site descriptor code based on the tailings area which they are monitoring.

The pertinent aspects of the coding system are as follows:

Tailings Area	Site Descriptor	Number of Sites
Crotch	C	8
Long Lake (Denison)	D	13
Nordic	N	7
Quirke	Q	11
Stanrock	S	10
Elliot Lake Sites	EL	3
Nordic Met Tower	NT	1 (4 monitors)
Quirke Met Tower	QT	1 (4 monitors)

In addition to the tailings areas Figure 3.1 also presents the locations of the two meteorological towers at Quirke and Nordic, the meteorological station at the CAIRS office, the three co-site MOL stations, the track-etch back-up stations (discussed in Chapter 6), the four mill complexes in operation during the monitoring period, and the fourteen mine exhausts. The three background sites are outside the limits of the figure and are simply denoted as:

BKGD 1	Mississaugi Provincial Park
BKGD 2	Blind River Hospital Roof
BKGD 3	East Bull Test Facility, subsequently moved to intersection of Highways #17 and #108 in November 1984.

4.0 MONITORING EQUIPMENT

This chapter describes the instrumentation used to monitor the radon levels, the theory of operation, the calibration of the monitors, and the meteorological instrumentation used.

4.1 Radon Monitoring

For this study prototype R.A.D. E-1 Time Averaged Electrostatically Enhanced Environmental Radon Monitors were used to measure ambient radon levels. The R.A.D E-1 monitor is a passive type using a polycarbonate plastic (CR39) detector coupled to an electrostatic enhancement system. Because of the electrostatic enhancement the unit provides the sensitivity and reliability to measure low ambient radon levels during exposure periods of 30 to 60 days. The high electrostatic field also minimizes the effect of humidity on the capture ability of the detector, which can be a problem in many passive radon/radon daughter detectors.

4.1.1 Monitor Components

The monitors were housed in rugged, vented, lockable metal cases, which for many of the installations were simply attached to trees with lag bolts at a height of 1 to 1.5 m from the ground. The monitors themselves consisted of two major components - the high voltage circuitry and the radon detection assembly. The high voltage circuitry generated the high voltage potential to create the electrostatic enhancement of the radon detector. An automatic capacity charging device, powered by conventional 9 volt dry cell batteries, created the high voltage potential difference of approximately 1200 volts.

The radon detection assembly consisted of a funnel shaped radon chamber and detector housing. The wall of the radon chamber was made of heavy plastic material with a metallic lining inside connected to ground potential. The large end of the radon chamber was covered with a selective membrane which allowed only radon gas to diffuse into the chamber. The small end of the chamber was connected to the detector housing, which consisted of an electrode connected to the negative potential of the high voltage circuitry, a conductive mylar film, a CR39 detector placed directly behind the mylar film and an airtight cap.

4.1.2 Theory of Operation

The radon monitor is exposed to the ambient air which contains radon gas, particulate matter in the form of dust and radon daughters, and moisture. The selective membrane which covers the end of the radon chamber allows only the radon to diffuse into the chamber and blocks out dust, radon daughters and moisture. Once inside the chamber the radon decays into its daughter products. These daughter products are positively charged particles which are attracted to the negative electrode by the electrostatic field set up in the radon chamber. When these particulate daughters, concentrated near the negative electrode of the detector housing, decay they give off energy in the form of alpha particles. These particles penetrate the mylar film and register in the CR39 detector. The amount of particle registration which occurs during the period of exposure is proportional to the mean concentration of radon which the detector was exposed to during the period.

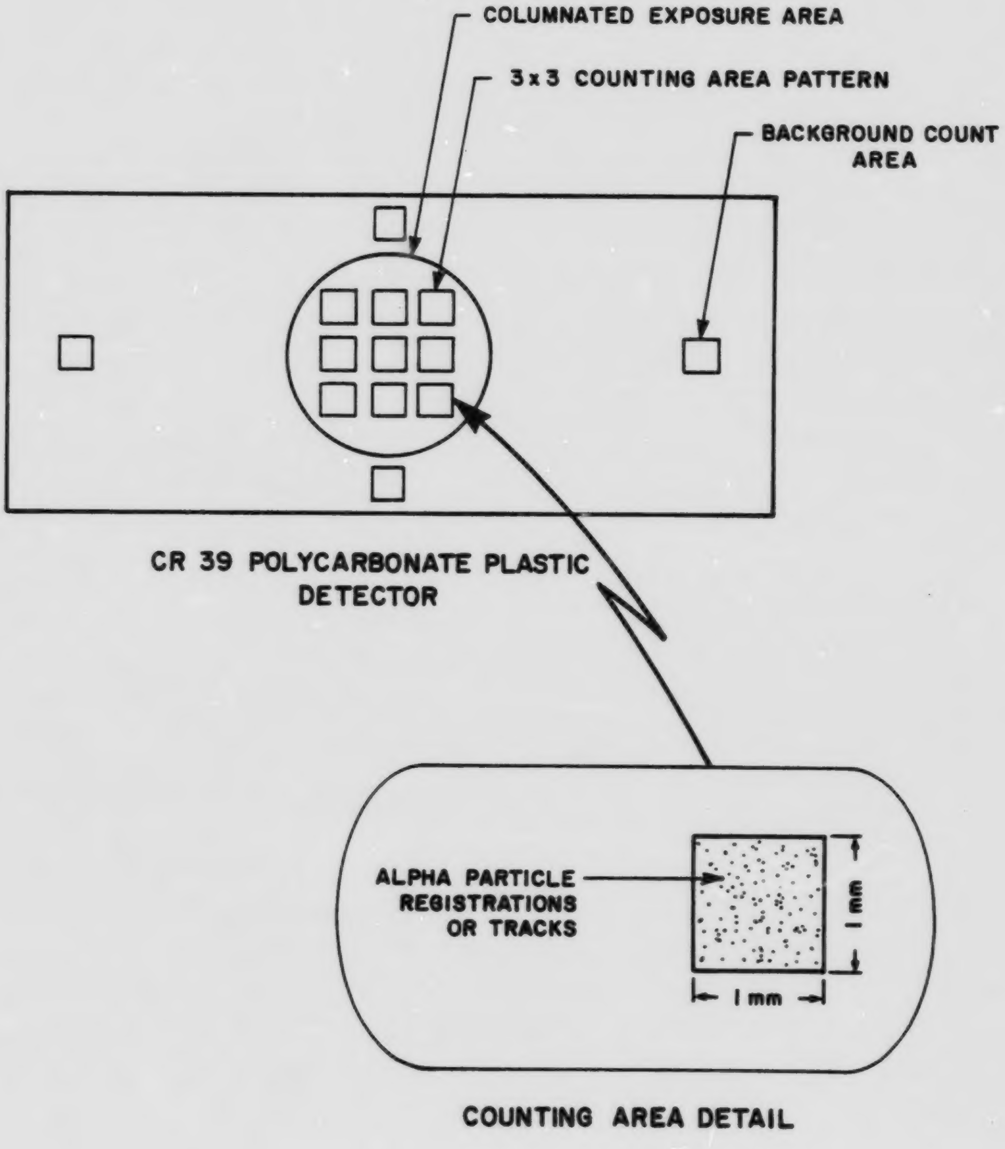
4.1.3 Detector Analysis

To determine the amount of particle registration the detector is etched in a 6.25 Normal sodium hydroxide solution at a temperature of 75°C for 4 hours. This etching process enlarges the registration points into discernible holes or tracks. Using a microscope these tracks are counted and when correlated with an appropriate calibration factor (and exposure period) are proportional to a specific radon gas concentration.

For the actual track counting operation the number of tracks in nine separate 1 mm^2 square areas, in a 3x3 arrangement, are counted and averaged to obtain an average track density over the columnated exposure area. Figure 4.1 depicts the columnated area on the detector and the non-columnated or

FIGURE 4·1

DETECTOR TRACK DISTRIBUTION AND COUNTING AREAS


COLUMNATED EXPOSURE AREA
3x3 COUNTING AREA PATTERN
BACKGROUND COUNT AREA
CR 39 POLYCARBONATE PLASTIC DETECTOR
ALPHA PARTICLE REGISTRATIONS OR TRACKS
1 mm
1 mm
COUNTING AREA DETAIL

background area of the detector. This background area is counted in four 1 mm^2 square areas. The track densities for these four areas are averaged to obtain a background count for radon exposure during shipping, handling and storage. This special pattern of track distribution enables the contribution of background to be deducted from the total exposure. For the R.A.D. E-1 the sensitivity is 345±5% tracks/0.1 pCi/litre.

4.1.4 Calibration

The instruments were calibrated using the Ontario Ministry of Labour radon chamber. The units were placed in the chamber (at a concentration of 1.1 Bq/L (30 pCi/L)) for various exposure periods to produce a calibration curve required for the detector analysis.

4.2 Meteorology

To monitor the wind on a micro scale during the study period aerovanes were installed on the Nordic and Quirke tailings areas. Temperature, relative humidity, barometric pressure and precipitation were measured on a macro scale with instrumentation installed on the roof of the CAIRS facility in Elliot Lake. The results of the meteorology monitoring are presented in Chapter 5.

4.2.1 Wind

Because wind was considered to be a micro specific parameter which could vary between tailings areas, two wind measurements systems were set-up. For the northern part of the study area measurements of wind speed and direction were recorded at a height of 10 m above the Quirke tailings area using a Climatronices 101150-WM-III Wind Recording System. The 12-volt battery powered system provided a strip chart record of wind speed and direction, which was subsequently abstracted and recorded on data sheets. Photo 4.1 depicts the Quirke wind system.

For the southern part of the study area measurements of wind speed and

PHOTO 4.1

QUIRKE INSTALLATION

10 METRE METEOROLOGICAL TOWER WITH RADON MONITORS INSTALLED AT 1M,2M,4M,& 8M.

THIS MET STATION RECORDS ONLY WIND SPEED AND DIRECTION ON A CONTINUOUS BASIS.

direction were recorded at a height of 10 m above the Nordic Tailings areas using a Meteorology Research Inc. Mechanical Weather Station. The 6-volt battery powered system provided a strip chart record of wind speed and direction. The unit also provided a record of temperature as sensed by a shielded, spiral, bimetal element. Photo 4.2 depicts the Nordic wind system.

4.2.2 Other Meteorological Parameters Monitored

Because the parameters of temperature, relative humidity, barometric pressure and precipitation were considered to be less micro specific than wind one monitoring station for these parameters was established. For security purposes and ease of maintenance and operation the station was installed on the roof of the CAIRS facility (depicted as station EL3 on the site map Figure 3.1).

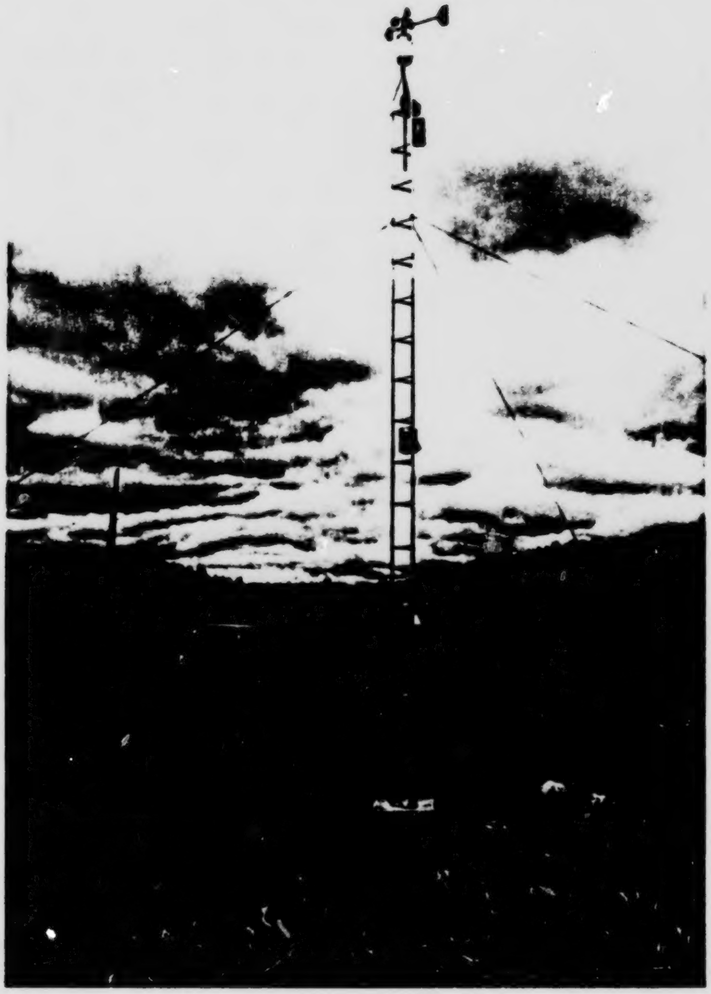
Ambient temperature, relative humidity and barometric pressure were measured using a Weathertronics Model 5005 Meteorograph located inside a single louvre Stevenson Screen. Temperature was sensed by an aged bimetal strip, humidity by a treated hair bundle and pressure by a 50 mm diameter, 11 bellows assembly. All three measurements were recorded on the same chart which was driven by a 7 day spring-wound clock mechanism. Photo 4.3 depicts the CAIRS installation.

To measure precipitation a standard rainfall gauge was attached to the side of the Stevenson screen (see photo 4.3a). For snowfall measurements the funnel/graduated cylinder assembly of the gauge was removed. Snow which accumulated in the large cylinder was melted and poured into the graduated cylinder to obtain its water equivalent in mm of rainfall.

During the winter months measurements of the depth of snow cover on the tailings were made at the Nordic and Quirke met tower sites. Measurements were based on a graduated stake which had been driven into the tailings prior to first snowfall.

PHOTO 4.2

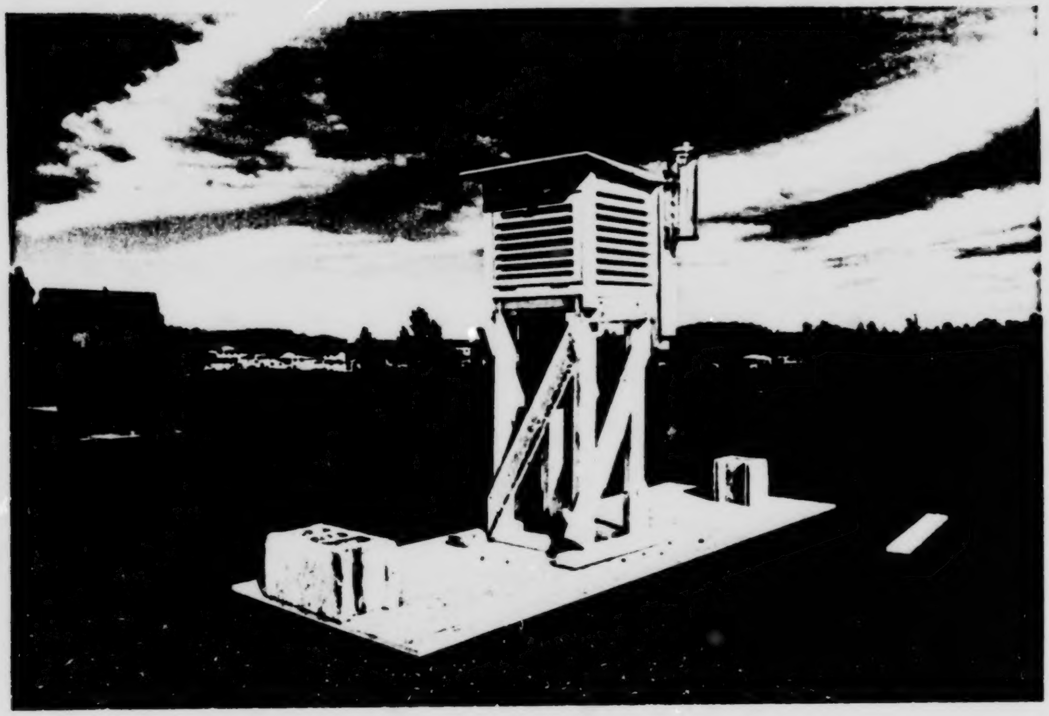
NORDIC TAILINGS INSTALLATION



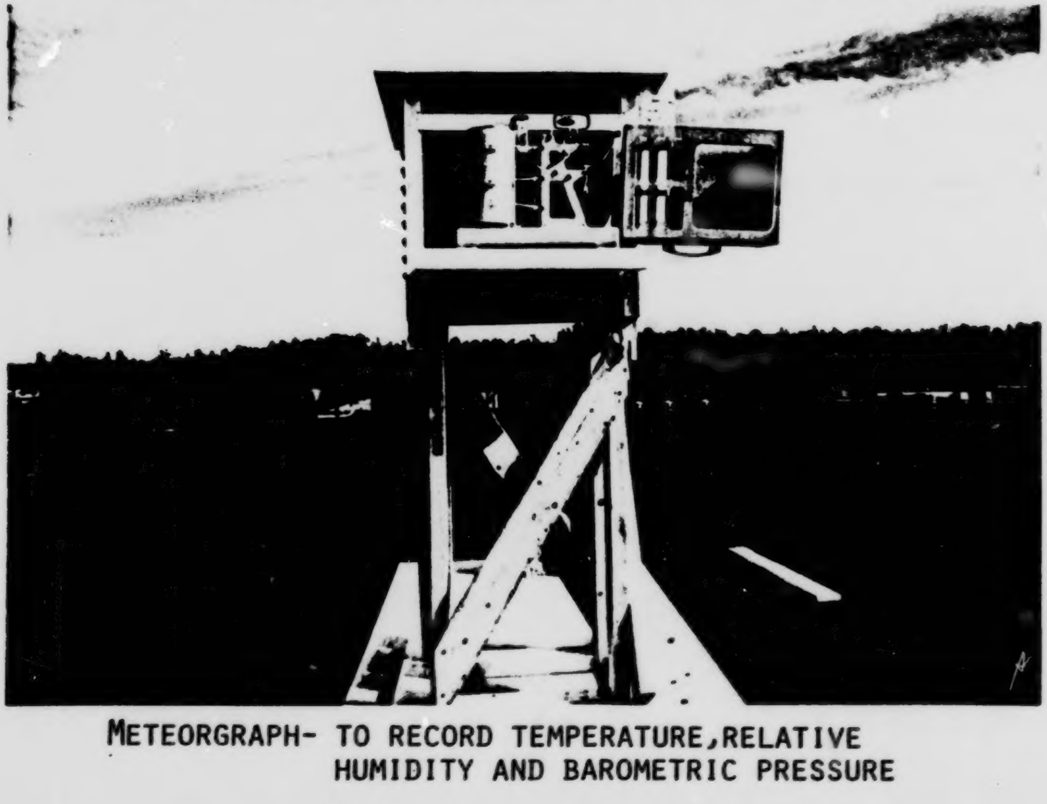
10 METRE METEOROLOGICAL TOWER WITH RADON MONITIORS INSTALLED AT 1M,2M,4M,& 8M. THIS MET STATION RECORDS WIND SPEED,DIRECTION AND TEMPERATURE ON A CONTINUOUS BASIS.

PHOTO 4.3

C.A.I.R.S. ROOFTOP INSTALLATION



STEVENSON SCREEN CONTAINING METEORGRAPH
PRECIPITATION GAUGE MOUNTED ON SIDE OF SCREEN



METEORGRAPH- TO RECORD TEMPERATURE, RELATIVE
HUMIDITY AND BAROMETRIC PRESSURE

4.3 Supplementary Radon Monitoring Program

Because of the worldwide use of Terradex track-etch detectors in the measurement of ambient and in-soil radon gas levels, a supplementary radon monitoring program at fifteen selected R.A.D. E1 monitor sites was implemented. These supplementary detectors (which operate on the same detection principle as the R.A.D. System except without the electrostatic enhancement) provided a set of back-up data, in the event of an instrument failure at a R.A.D. E1 site, and also a set of comparison data with which to assess the results from conventional passive-type detectors and the more sophisticated electrostatically-enhanced R.A.D detectors.

However, because these Terradex units are less sensitive to environmental levels of radon the detectors were left in the field for 3 and 6 month periods as compared with the one month exposure period for the R.A.D. monitors. The sites selected for this supplementary monitoring are shown on Figure 3.1.

Table 4.1 provides a summary of locations selected and monitoring periods for this supplementary radon monitoring program.

Table 4.1

Supplementary Radon Monitoring Program

Tailings Area	Station	Monitoring Periods (1984-1985)
Quirke	Q3	Oct-Jan, Jan-Mar, Mar-May
	Q4	Oct-Jan, Jan-May
	Q6	Sept-Mar, Mar-May
Stanrock	S5	Oct-Mar, Mar-Jun
	S8	Oct-Mar, Mar-Jun
	S10	Oct-Jan, Jan-Mar, Mar-Jun
Nordic	N2	Oct-Jan, Jan-Jun
	N5	Oct-Mar, Mar-Jun
	N7	Oct-Jan, Jan-Mar, Mar-Jun
Crotch	C6	Oct-Mar, Mar-? site unaccessible
	C7	Oct-Jan, Jan-Jun
Denison	D11	Oct-Jan, Jan-Mar, Mar-May
	D12	Oct-Jan, Jan-May
Elliot Lake	EL3	Sept-Jan, Jan-Mar, Mar-May
Background	BKGD3	Sept-Jan, Jan-May

5.0 METEOROLOGICAL RESULTS

The raw meteorological data were abstracted from the strip charts (Quirke & Nordic stations) and drum charts (CAIRS station). The following sections provide summaries of the abstracted data for the various met parameters.

5.1 Wind

Wind plays a major role in the dispersion of radon from a source, whether it be a tailings area, mine exhaust or mill complex. To provide data on local wind, standard 10 m towers and wind recorders were erected on the Quirke and Nordic tailings areas.

5.1.1 Quirke Tower

The Quirke tower (QT) was installed at the location shown on Figure 3.1 and on Photo 4.1. The area was unobstructed for several hundred metres in all directions and the ground surface supported only a sparse growth of long bladed grass.

The recorder was to be operated for the entire radon monitoring period however the dusty environment of the Quirke tailings required the unexpected removal of Climatronics wind recording system for repair on two separate occasions.

Figure 5.1 presents a histogram of the windspeed and directions observed at the Quirke Tower for the months of July, September, November and January 1985.

5.1.2 Nordic Tower

The Nordic tower (NT) was installed at the location shown on Figure 3.1 and on Photo 4.2. The ground surrounding the tower supported a well established grass cover. Small trees (4-5 m) could be found within 75 m of the tower. Despite small periods of equipment recorder problems, the mechanical weather station operated for the entire radon monitoring period.

FIGURE 5.1

WIND DISTRIBUTION HISTOGRAMS

FOR QUIRKE

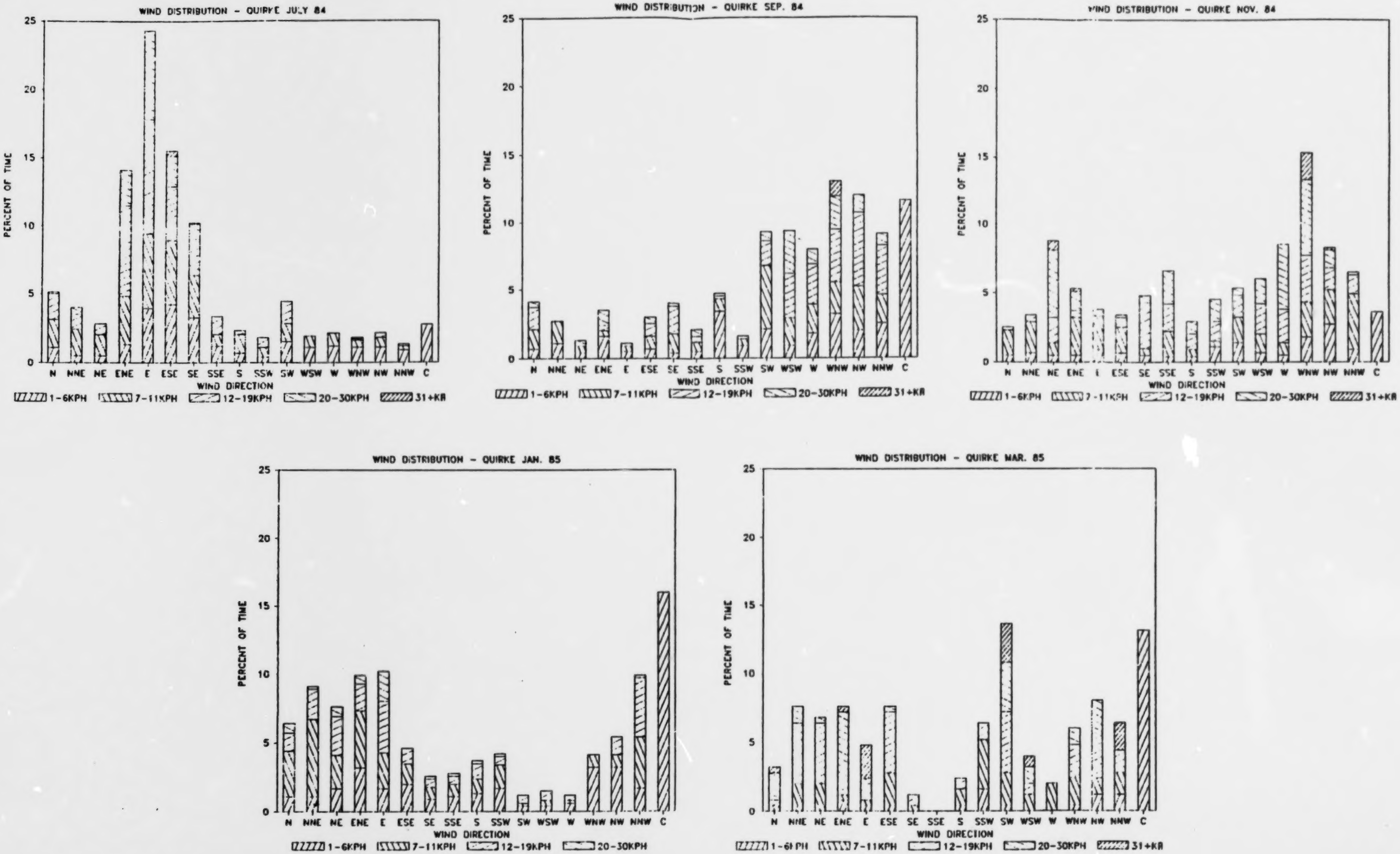


Figure 5.2 presents a histogram of the wind speeds and directions observed at the Nordic Tower for the months of July, September, November 1984 and January, March and May 1985.

5.2 Temperature

Temperature can be an important parameter in radon dispersion with respect to source strength and thermal instability of the air. For example, during periods of low temperatures (<0°C) the surface of the tailings may be frozen thereby reducing the source strength and the thermal lift from the ground surface. A summary of the temperature statistics is presented in Table 5.1. Figure 5.3 depicts the monthly variation in temperature during the radon monitoring period (June 1984 to June 1985) as measured at the CAIRS and Nordic Tower stations.

The mean daily temperatures ranged from a low in January of -11.9°C at CAIRS and -11.7°C at Nordic to a high in August of 19.2°C at CAIRS and 16.2°C in July at Nordic. Overall the stations were in close agreement with respect to mean daily temperature.

Figure 5.4 presents the mean daily maximum and minimum temperatures recorded at the two stations. The mean daily maximum ranged from a high in August of 24.3°C at CAIRS and 21.1°C at Nordic to a low in January of -8.5°C at CAIRS and -7.7°C at Nordic. The mean daily minimum ranged from a high in August of 14°C at CAIRS and 11.4°C at Nordic to a minimum in January of -15.2°C at CAIRS and -15.6°C at Nordic.

The extreme maximum and minimum temperatures recorded at the CAIRS and Nordic Tower stations are presented on Figure 5.5. The extreme maximums were +30°C at CAIRS for both July and August and 29°C at Nordic for May. The extreme minimums were less than -20°C for December, January and February at CAIRS and -25°C for February at Nordic Tower.

Table 5.1

METEOROLOGICAL DATA SUMMARY - TEMPERATURE AND RELATIVE HUMIDITY

			Temperature (°C)					Relative Humidity (%)		
Station	Year	Month	Daily Mean	Max Mean	Min Mean	Extreme Max	Extreme Min	Daily Mean	Max Mean	Min Mean
CAIRS	1984	Jun	16.0	20.3	11.6	27	7	59.4	77	38
		Jul	18.2	23.1	13.2	30	7	56.7	70	44
		Aug	19.2	24.3	14.0	30	8	61.2	75	44
		Sep	11.6	15.8	7.5	22	0	61.4	75	50
		Oct	8.8	12.8	4.7	23	-5	66.0	84	46
		Nov	0	3.1	-3.1	10	-10	61.2	80.5	42.5
		Dec	-6.3	-2.9	-9.6	7	<-20	68.0	82	58.5
	1985	Jan	-11.9	-8.5	-15.2	-3	<-20	64.9	78	50.5
		Feb	-9.6	-6.1	-13.2	4	<-20	62.0	76	43
		Mar	-2.7	-0.5	-4.8	3	-13	52.0	72	34
		Apr	4.2	7.3	1.1	24	-5	58.2	77	32
		May	11.8	16.0	7.5	24	0	51.2	75	24
		Jun	13.8	18.3	9.2	28	4	51.0	70.5	33.5
Nordic	1984	Jun	12.0	17.5	7.5	25	10			
		Jul	16.2	21.1	11.4	25	5			
		Aug	14.9	20.2	9.6	28	4			
		Sep	10.2	14.5	5.8	23	0			
		Oct	8.9	13.3	4.4	24	-3			
		Nov	1.0	4.7	-2.8	11	-8			
		Dec	-7.6	-2.9	-12.2	10	-23			
	1985	Jan	-11.7	-7.7	-15.6	-4	-22.5			
		Feb	-8.5	-4.0	-12.9	7	-25			
		Mar	-1.2	4.1	-6.4	10	-15			
		Apr	6.5	11.5	1.5	28	-12			
		May	14.1	19.4	8.8	29	1			
		Jun	12.9	18.2	7.5	27	2			

FIGURE 5.2

WIND DISTRIBUTION HISTOGRAMS FOR NORDIC

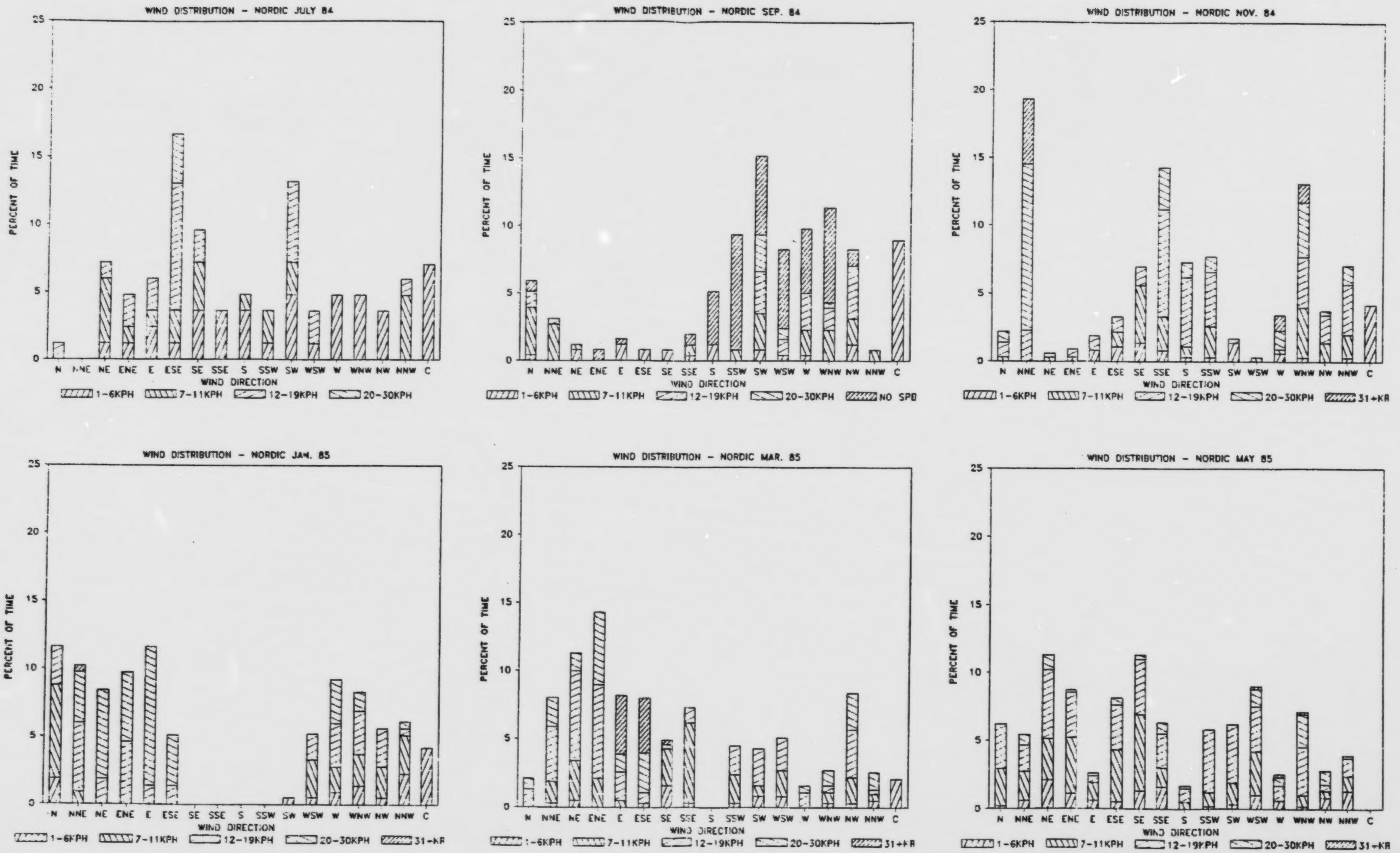


FIGURE 5.3

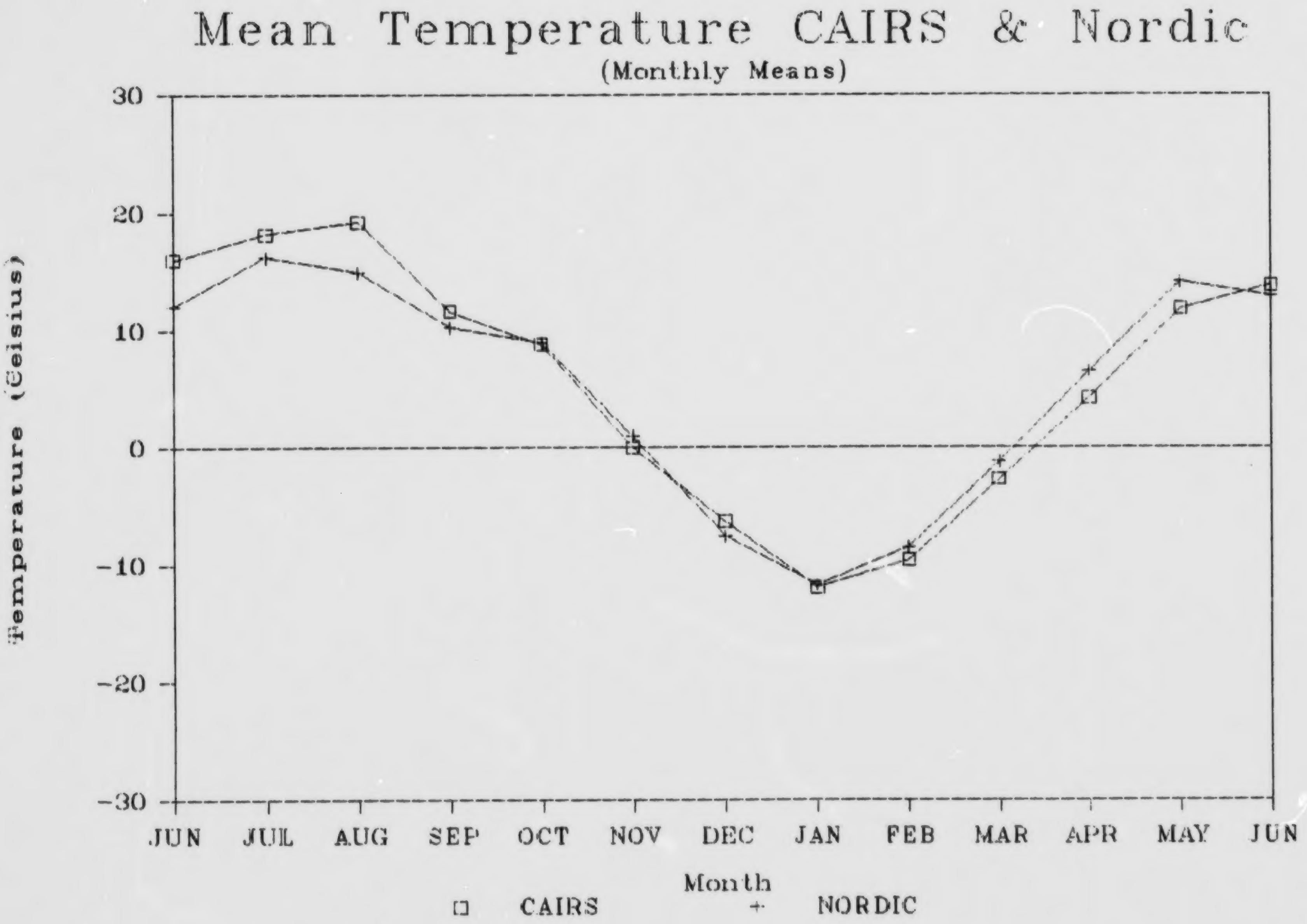
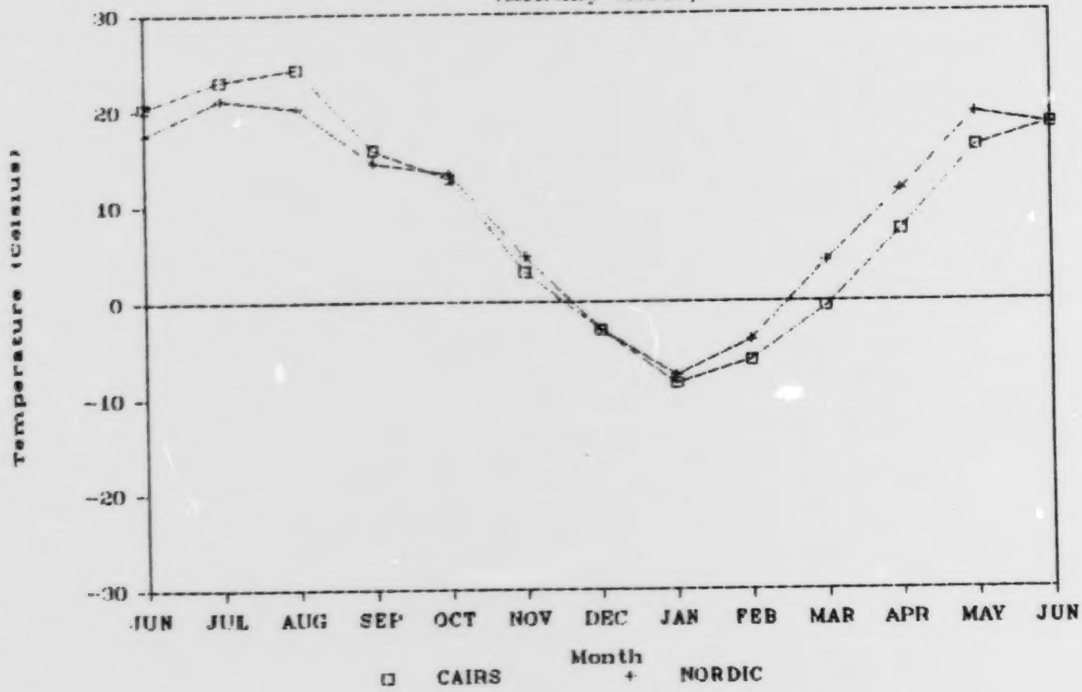

Mean Temperature CAIRS & Nordic
(Monthly Means)
Temperature (Celsius)
30
20
10
0
−10
−20
−30
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
Month
□ CAIRS
+ NORDIC

FIGURE 5.4

Mean Daily Maximum Temperature

(Monthly Means)



Mean Daily Minimum Temperature

(Monthly Means)

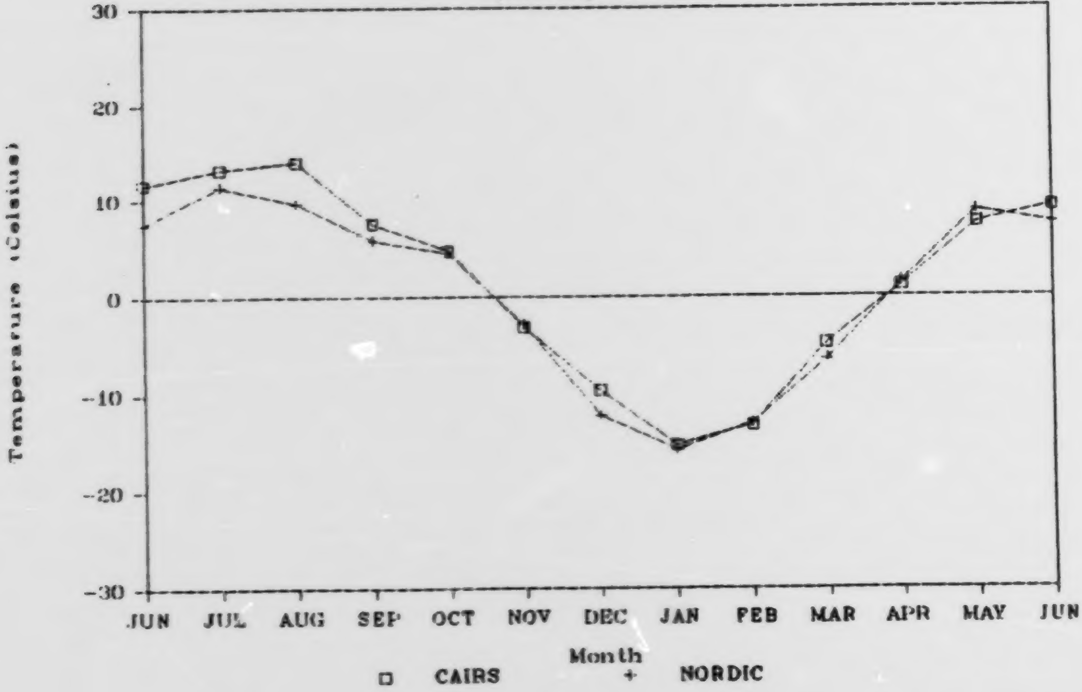
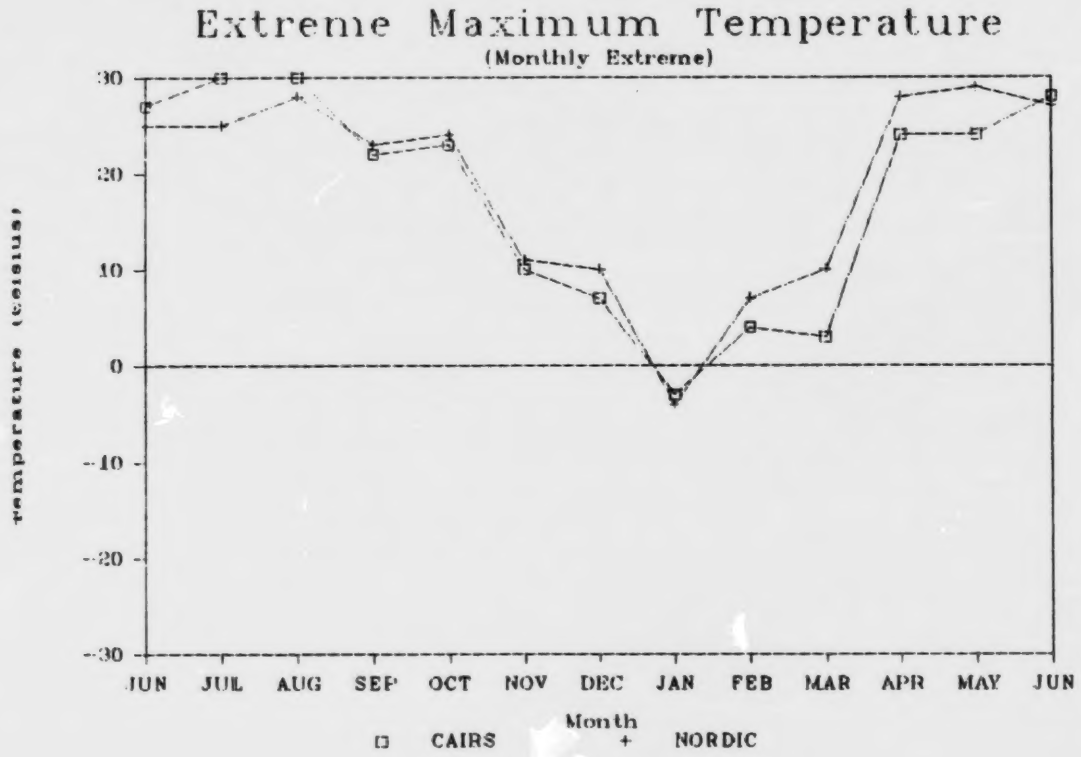
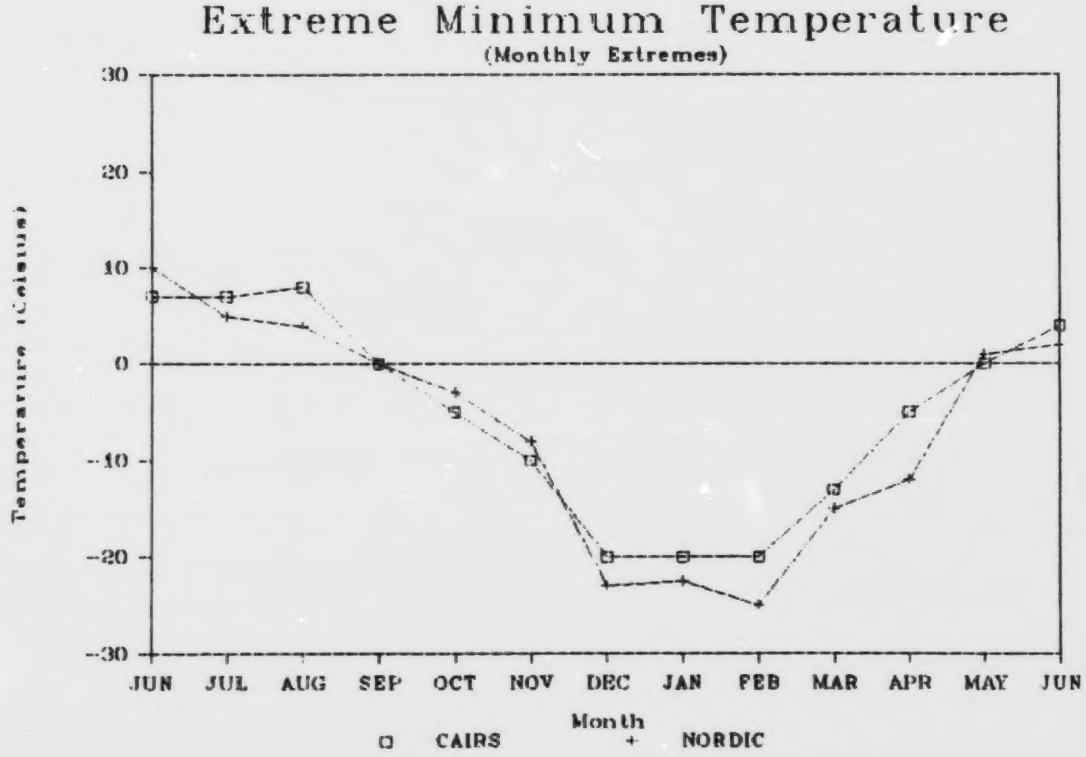


FIGURE 5.5


Extreme Maximum Temperature
(Monthly Extreme)
Temperature (Celsius)
30
20
10
0
-10
-20
-30
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
Month
□ CAIRS
+ NORDIC


Extreme Minimum Temperature
(Monthly Extremes)
Temperature (Celsius)
30
20
10
0
-10
-20
-30
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
Month
□ CAIRS
+ NORDIC

5.3 Relative Humidity

Relative humidity is a measure of the water vapour content of the air and reflects the extremes under which the radon monitors must operate. A summary of the relative humidity statististics is presented on Table 5.1. Figure 5.6 depicts the trends in the mean relative humidity levels measured during the radon monitoring period. The mean relative humidity ranged from a high of 68% in December to a low of 57% in May. The range of mean monthly maximum and minimum were 84% in October to 24% in May respectively.

5.4 Barometric Pressure

The rate of radon exhalation from a tailings surface has been demonstrated to be inversely effected by the barometric pressure, (Kraner et al., 1964; Bigu et al., 1982) that is to say as the barometric pressure increases the rate of radon leaving the surface of the tailings is decreased. Conversely as the barometric pressure decreases the rate of radon release increases.

Figure 5.7 presents a summary of mean monthly barometric pressures measured during the study period.

5.5 Precipitation

Precipitation whether in the form of rainfall or snowfall can influence the amount of radon released from the surface of tailings. Results from the study carried out at the Lacnor tailings area show a marked difference in radon exhalation rates between wet and dry tailings, and snow covered and non-covered tailings (Golder Associates et al., 1986).

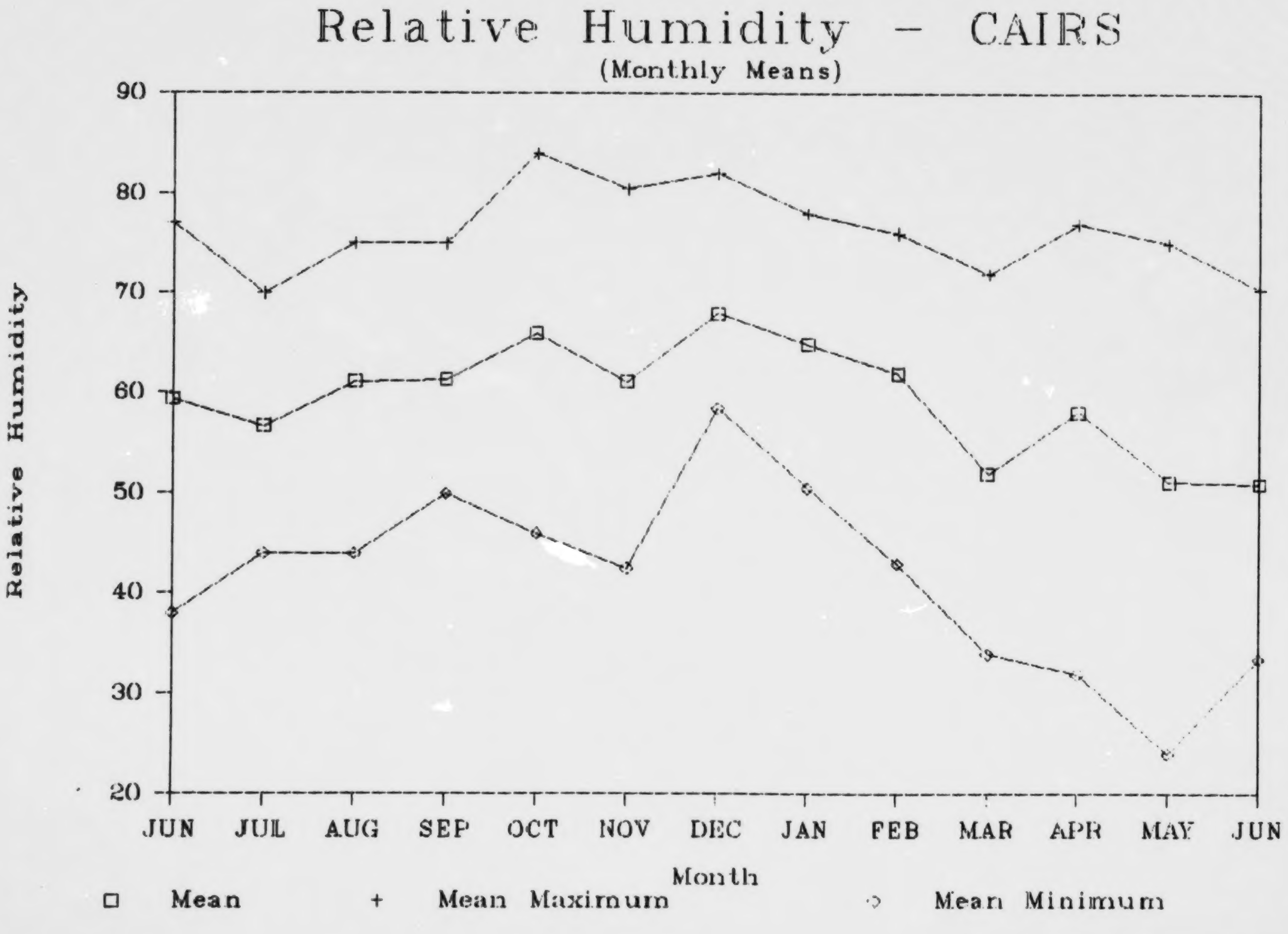
Table 5.2 presents a summary of the precipitation statistics while Figure 5.8 presents a histogram of precipitation as measured at the CAIRS station. The total amount of precipitation which fell during the monitoring period was approximately 90 mm. Of this total nearly 57% fell during the five months of August to December 1984. The remaining 43% was distributed more or less

Table 5.2

METEOROLOGICAL DATA SUMMARY - PRECIPITATION

Station	Year	Month	Precipitation (mm) Monthly Total
CAIRS	1984	Jun	40 (half month)
		Jul	36
		Aug	89
		Sep	115
		Oct	108
		Nov	119
		Dec	81
	1985	Jan	33
		Feb	51
		Mar	69
		Apr	47
		May	54
		Jun	46

FIGURE 5.6



Relative Humidity – CAIRS
(Monthly Means)

FIGURE 5.7

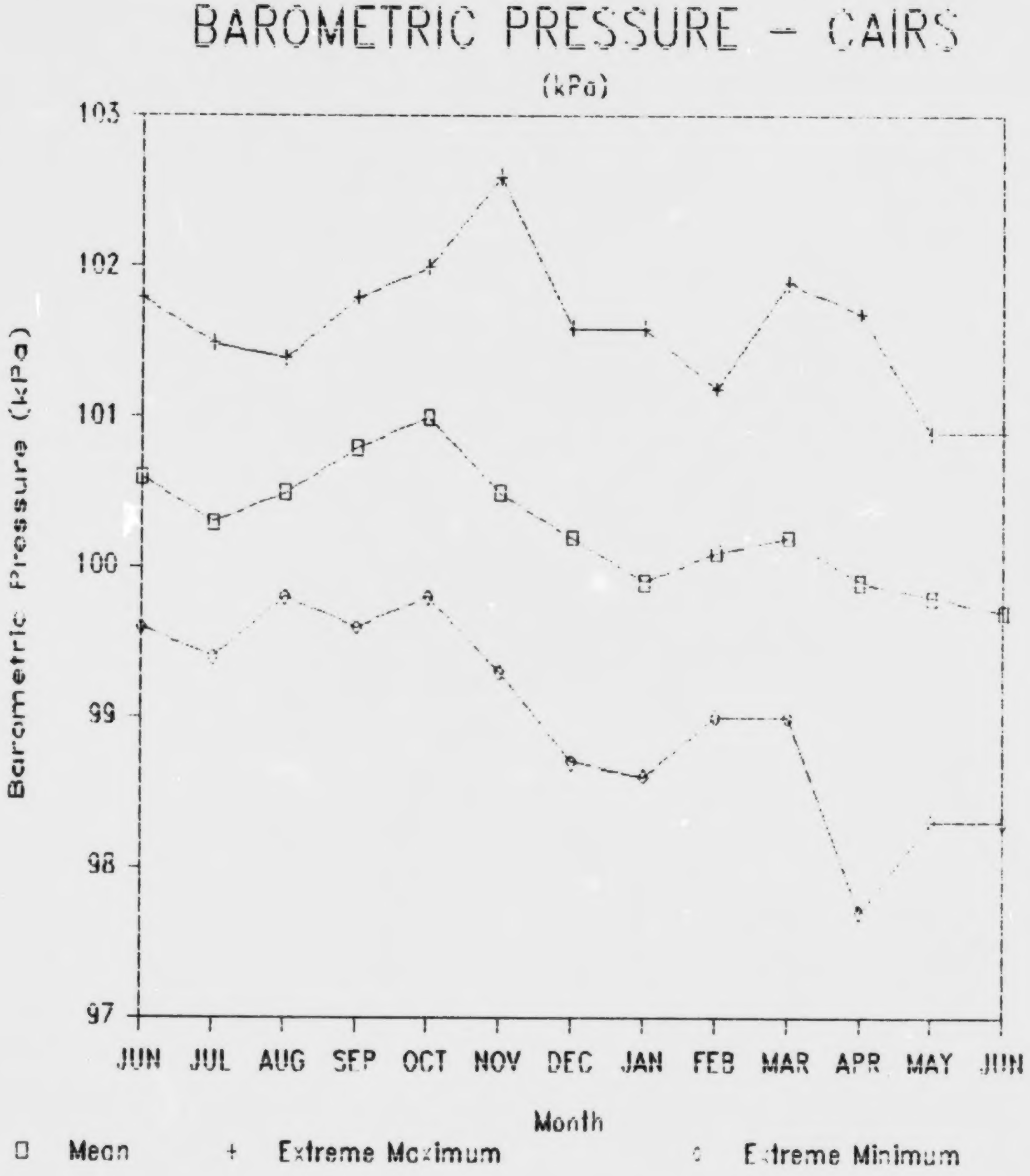
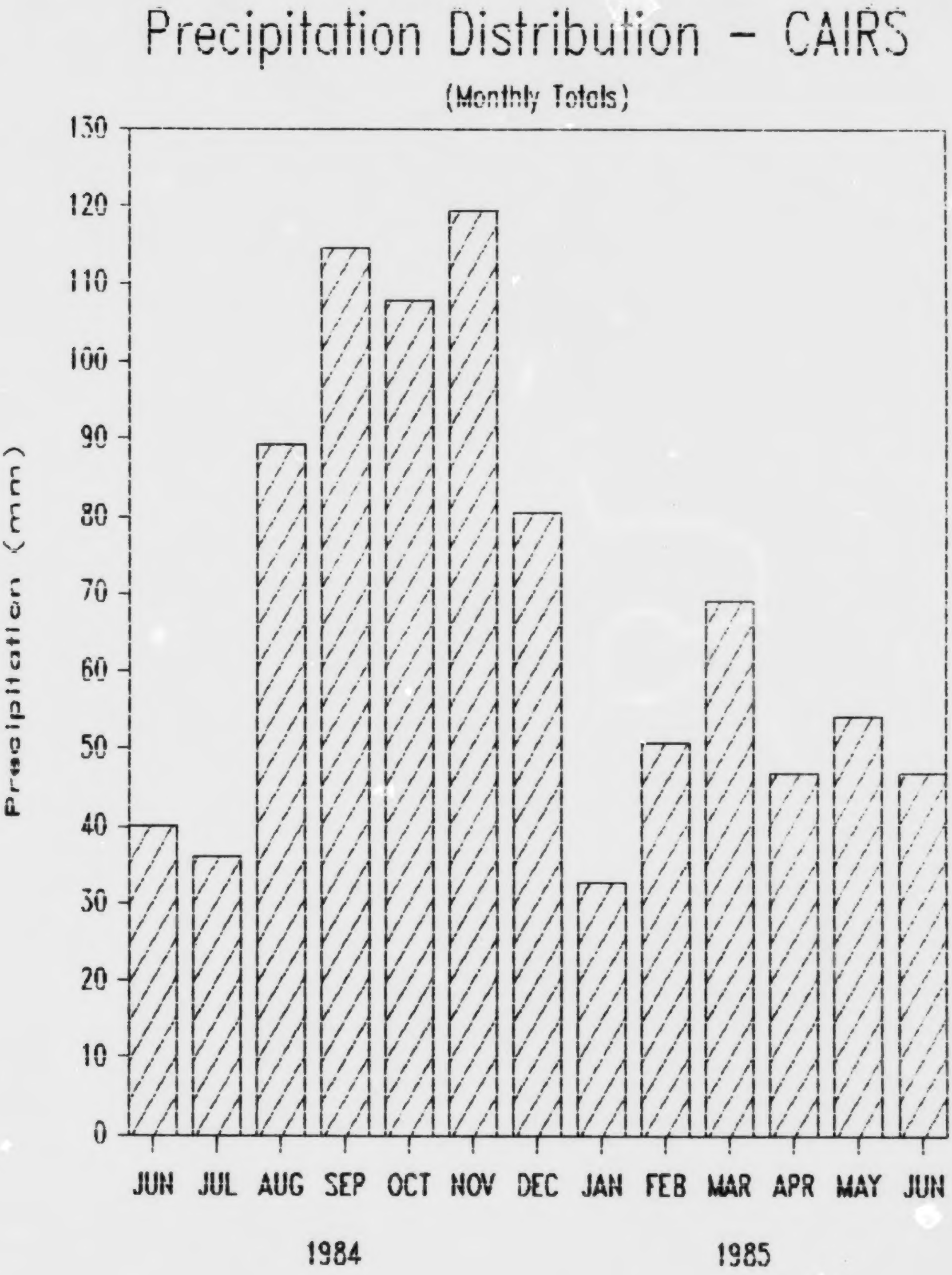

BAROMETRIC PRESSURE - CAIRS
(kPa)
Barometric Pressure (kPa)
103
102
101
100
99
98
97
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
Month
□ Mean
+ Extreme Maximum
◇ Extreme Minimum

FIGURE 5.8



Precipitation Distribution - CAIRS
(Monthly Totals)
Precipitation (mm)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
1984
1985

evenly throughout the remaining 8 months.

5.6 Snow Cover

Measurements of snow cover on the Nordic and Quirke tailings area were recorded throughout the winter. Table 5.3 presents a summary of these observations. Snow was present on the tailings areas from the beginning of December until the middle of April. For the Quirke and Nordic sites the maximum depths observed were 430 mm and 535 mm respectively.

Table 5.3

Snow Cover Observations

Date	Quirke	Nordic
Dec 3 84	Snow Depth 100 mm	Snow Depth 100 mm
11	Patchy 0-150 mm	Patchy 50-255 mm
14		Patchy 0-100 mm
18	50 mm at stake, tailings 0-150 mm	100 mm at stake tailings 50-255 mm
27		100 mm at stake, tailings 50-255 mm
Jan 9 85	200 mm at stake	
14		255 mm
16		230 mm
26	230 mm fairly uniform	
28		305 mm fairly uniform
Feb 6	305	
15		405
25	405	430
26	430	
Mar 12	430	
19	405	535
21	405	
22		510
Apr 11	330	
12		355
23	Tailings surface open, thawed, no snow	

6.0 RADON MONITORING RESULTS

Summaries of the radon monitoring results for each of the tailings areas and background areas are presented in the following sections. The individual station results are presented in the data sheets at the end of Chapter 7.

It should be noted that during the analysis of some detectors the difference between the number of alpha particle registrations or tracks within the columnated area and the background area was so small as to be Statistically Not Significant (SNS). In these cases the supplier did not report results. Such data are reported in the tables as SNS values, and may be thought of as extremely low concentrations of radon, well below the limit of detection for the R.A.D. E-1 monitor.

6.1 Crotch Tailings

The Crotch tailings area is an active and unvegetated area currently operated by Rio Algom Limited. A total of eight monitors were located in the area surrounding the Crotch tailings. Table 6.1 summarizes this spatial arrangement. The closest monitor was C6 located approximately 50 m from tailings while C1 was nearly 1500 m from tailings but within 350 m of a mine exhaust.

A summary of the results for the eight monitoring stations is presented in Table 6.2 and on Figure 6.1. The mean radon concentration for the overall tailings area was 0.006 Bq/L (0.16 pCi/L) and ranged from a detectable low of 0.001 Bq/L (0.03 pCi/L) at C2 to a high of 0.028 Bq/L (0.76 pCi/L) at C4.

The individual monitoring results for Stations C1 to C8 are presented in the data sheets at the end of Chapter 7.

6.2 Denison (Long Lake) Tailings

The Long Lake Tailings Management Area is an active and non-vegetated area

Table 6.1

Crotch Tailings - Radon Monitor Station Location Summary

Station	Distance (m)*	Direction**	Comments
C1	1500	W	Strouth Lake Pump House
C2	850	SW	Sheriff Creek
C3	200	W	Waste Water Canal
C4	75	W	
C5	300	NE	
C6	50	N	Crotch Treatment Plant
C7	100	E	
C8	1200	E	New Treatment plant

* Distance to closest edge of tailings

** Direction of monitor from tailings

Table 6.2

Crotch Tailings - Total Area Results Summary

Total Number of Results - 79

Total Number of S.N.S. Results - 21

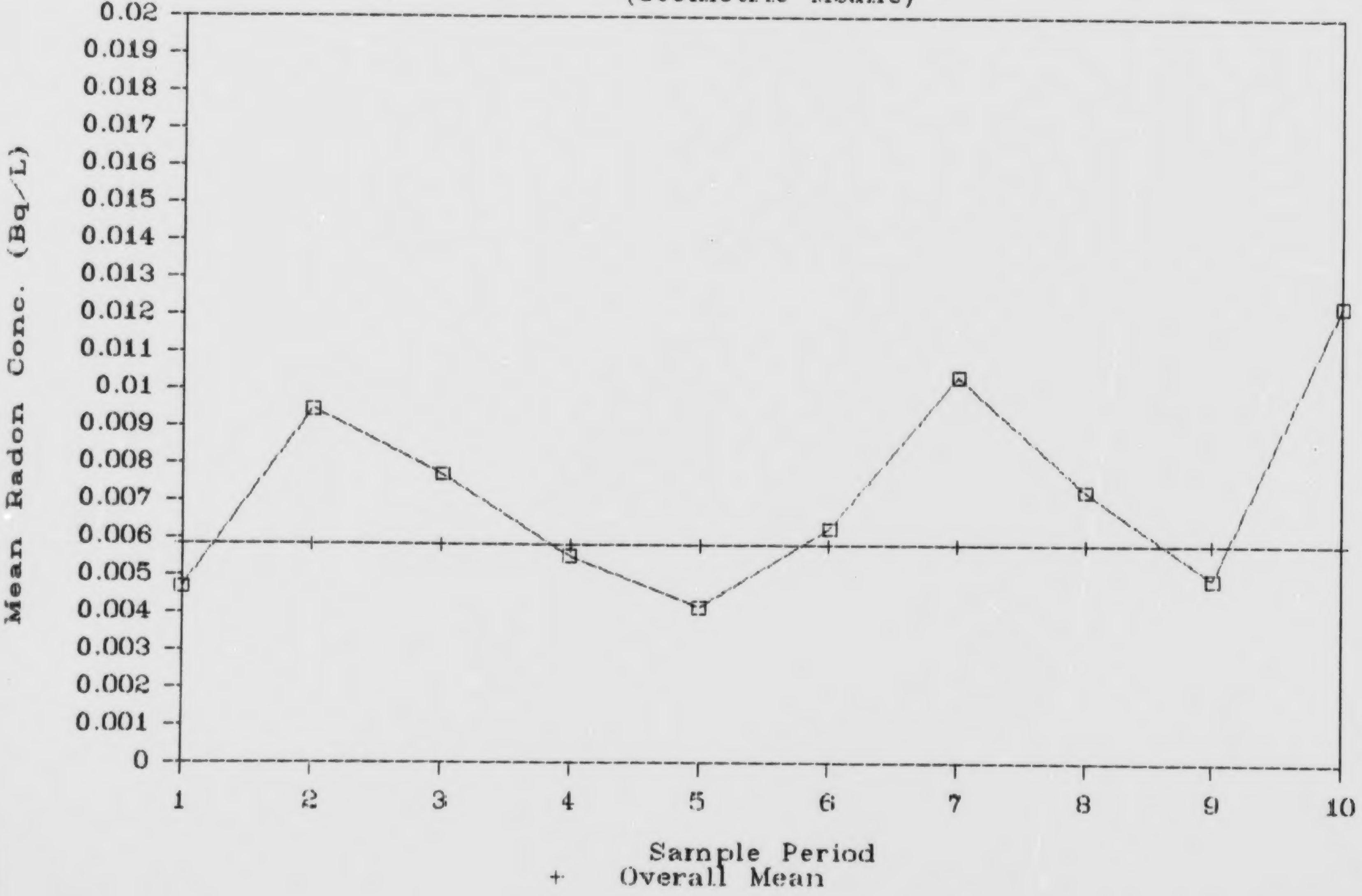
Geometric Mean	0.006 Bq/L (0.16 pCi/L)
Geometric Std. Dev.	2.61

Maximum Value	0.028 Bq/L (0.76 pCi/L)
Minimum Value	0.001 Bq/L (0.03 pCi/L)

FIGURE 6.1

Mean Radon Concentrations – Crotch

(Geometric Means)



currently operated by Denison Mines Limited. For this study the thirteen monitors installed around the tailings area and mine/mill complex were identified as D1 to D13. Table 6.3 summarizes the spatial arrangement of the monitoring stations. The closest monitors to the Long Lake tailings (100 m) were at stations D11 and D12 while the farthest away (2600 m) was station D8 on the Stanrock Road. Stations D2 and D3 were also located in close proximity (100 m) to tailings (Williams Lake Tailings Area) while D3 was located in close proximity to the mill complex.

A summary of the results for the thirteen monitoring stations is presented in Table 6.4 and on Figure 6.2. The mean radon concentration for the Denison monitoring stations was 0.006 Bq/L (0.16 pCi/L) and ranged from a detectable low of <0.001 Bq/L (0.001 pCi/L) at D10 to a high of 0.034 Bq/L (0.92 pCi/L) at D11.

The individual radon monitoring results for stations D1 to D13 are presented in the data sheets at the end of Chapter 7.

6.3 Nordic Tailings (including Tower Sites)

The Nordic Tailings area is an inactive and vegetated site managed by Rio Algom Limited. Access to the area surrounding this tailings site is quite limited and for this reason the locations of the radon monitors as shown on Table 6.5 are shorter than for most of the other tailings areas. Two sites, N3 and N4 were within 50 m of the tailings, while N1 and N2 were the farthest away at 400 m and 500 m respectively. N1 was initially installed at the MOL Nordic radon daughter sampling station however the entire station was removed prior to the initiation of the SENES monitoring program.

A summary of the results for the seven monitoring stations is presented in Table 6.6 and on Figure 6.3 the mean radon concentration for all the Nordic monitoring stations was 0.020 Bq/L (0.53 pCi/L), the highest average of all the tailings area. The range of radon levels was from a low of 0.002 Bq/L (0.05 pCi/L) at N7 to a high of 0.255 Bq/L (6.89 pCi/L) at NT1.

Table 6.3

Denison Tailings - Radon Monitor Station Location Summary

Station	Distance (m)*	Direction**	Comments
D1	1500	NW	
D2	100	W	Dam 1 Williams L. tailings
D3	100	N	Mill complex area
D4	800	E	pump house
D5	150	E	
D6	750	SE	Sp. American site
D7	1000	S	Olive Lake
D8	2600	SE	Stanrock Road
D9	2000	SW	Flag Lake
D10	700	W	Stolley Lake
D11	100	N	Dam 10
D12	100	S	Dam 16
D13	300	N	

* Distance to closest edge of tailings

** Direction of monitor from tailings

Table 6.4

Denison Tailings - Total Area Results Summary

Total Number of Results - 127

Total Number of S.N.S. Results - 42

Geometric Mean	0.006 Bq/L (0.16 pCi/L)
Geometric Std. Dev.	2.11
Maximum Value	0.034 Bq/L (0.92 pCi/L)
Minimum Value	0.0004 Bq/L (0.01 pCi/L)

FIGURE 6.2

Mean Radon Concentrations – Denison

(Geometric Means)

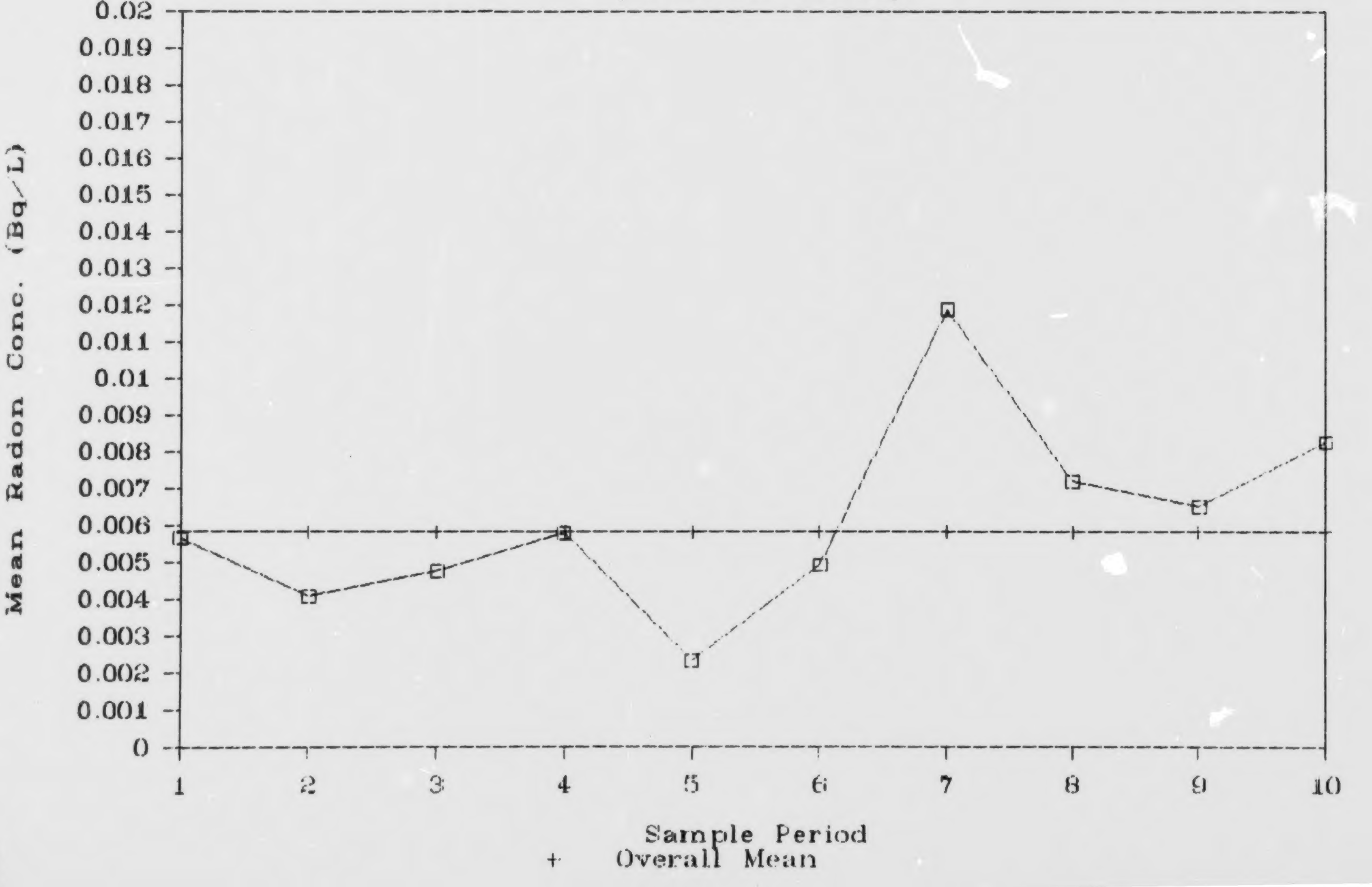


Table 6.5

Nordic Tailings - Radon Monitor Station Location Summary

Station	Distance (m)*	Direction**	Comments
N1	400	S	Nordic Townsite
N2	500	E	
N3	50	N	
N4	50	N	
N5	75	W	
N6	200	S	Nordic mine site
N7	175	S	CANMET facility

* Distance to closest edge of tailings

** Direction of monitor from tailings

Table 6.6

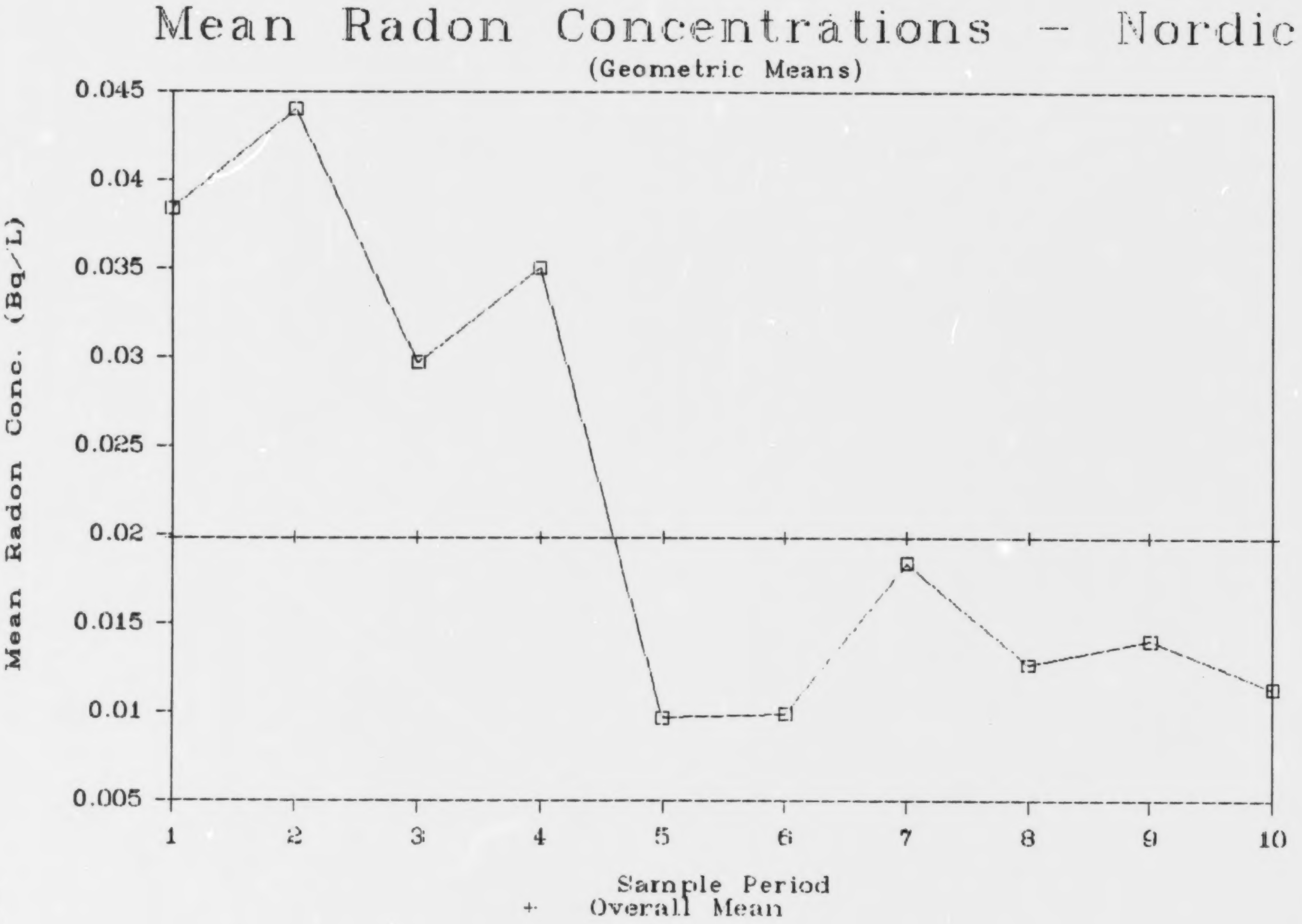
Nordic Tailings - Total Area Results Summary

Total Number of Results - 110

Total Number of S.N.S. Results - 18

Geometric Mean	0.020 Bq/L (0.53 pCi/L)
Geometric Std. Dev.	2.9
Maximum Value	0.255 Bq/L (6.89 pCi/L)
Minimum Value	0.002 Bq/L (0.05 pCi/L)

FIGURE 6.3



Mean Radon Concentrations – Nordic

(Geometric Means)

The individual radon monitoring station results for N1 to N7 and NT1 to NT4 are presented in the data sheets at the end of Chapter 7.

6.4 Quirke Tailings (including Tower Sites)

The Quirke tailings area is an active site operated by Rio Algom Limited. The site contains both vegetated and non-vegetated tailings with portions of the northern half of the tailings area separated into vegetated cells. The Quirke tower site was located in one of these vegetated cells.

The spatial distribution of the monitors is summarized on Table 6.7. The proximity of the monitors to the tailings areas ranges from 100 m for Q6 to 4200 m for Q1. The Q1 site was selected to monitor the radon levels in the area of the nine mine exhausts as shown on Figure 3.1. Station Q2 at 1000 m from the tailings was co-sited with the MOL radon daughter sampler at the Quirke townsite/mill complex.

A summary of the results for the eleven monitoring stations is presented in Table 6.8 and on Figure 6.4. The mean radon concentration for all the Quirke monitoring stations was 0.011 Bq/L (0.30 pCi/L) and ranged from a low of 0.001 Bq/L (0.04 pCi/L) at Q1 and Q4 to a maximum of 0.098 Bq/L (2.64 pCi/L) at QT1.

The individual radon monitoring results for stations Q1 to Q11 and QT1 to QT4 are presented in the data sheets at the end of Chapter 7.

6.5 Stanrock Tailings

The Stanrock tailings area is an inactive non-vegetated site currently managed by Denison Mines Limited. A total of ten radon monitors were installed in the vicinity of the tailings. The spatial distribution of these monitors is summarized in Table 6.9. The most distant site is S1 at nearly 1600 m from the main portion of the Stanrock tailings site. Sites S2 and S3 are also quite a distance at 1100 and 1500 m respectively. The closest station S10 is located approximately 50 m from the tailings.

Table 6.7

Quirke Tailings - Radon Monitor Station Location Summary

Station	Distance (m)*	Direction**	Comments
Q1	4200	E	Panel Mine Road
Q2	1000	NE	Quirke townsite/mill
Q3	300	NE	Pipeline trestle
Q4	200	N	Main dam
Q5	600	N	Berm M Gravel Pit Lake
Q6	100	NW	Dam L
Q7	400	W	Dyke Q
Q8	200	SW	Dam J
Q9	150	S	
Q10	700	S	Evans Lake Channel
Q11	300	SE	CIL Explosives plant

* Distance to closest edge of tailings

** Direction of monitor from tailings

Table 6.8

Quirke Tailings - Total Area Results Summary

Total Number of Results - 144

Total Number of S.N.S. Results - 32

Geometric Mean	0.011 Bq/L (0.30 pCi/L)
Geometric Std. Dev.	2.7
Maximum Value	0.098 Bq/L (2.64 pCi/L)
Minimum Value	0.001 Bq/L (0.04 pCi/L)

FIGURE 6.4

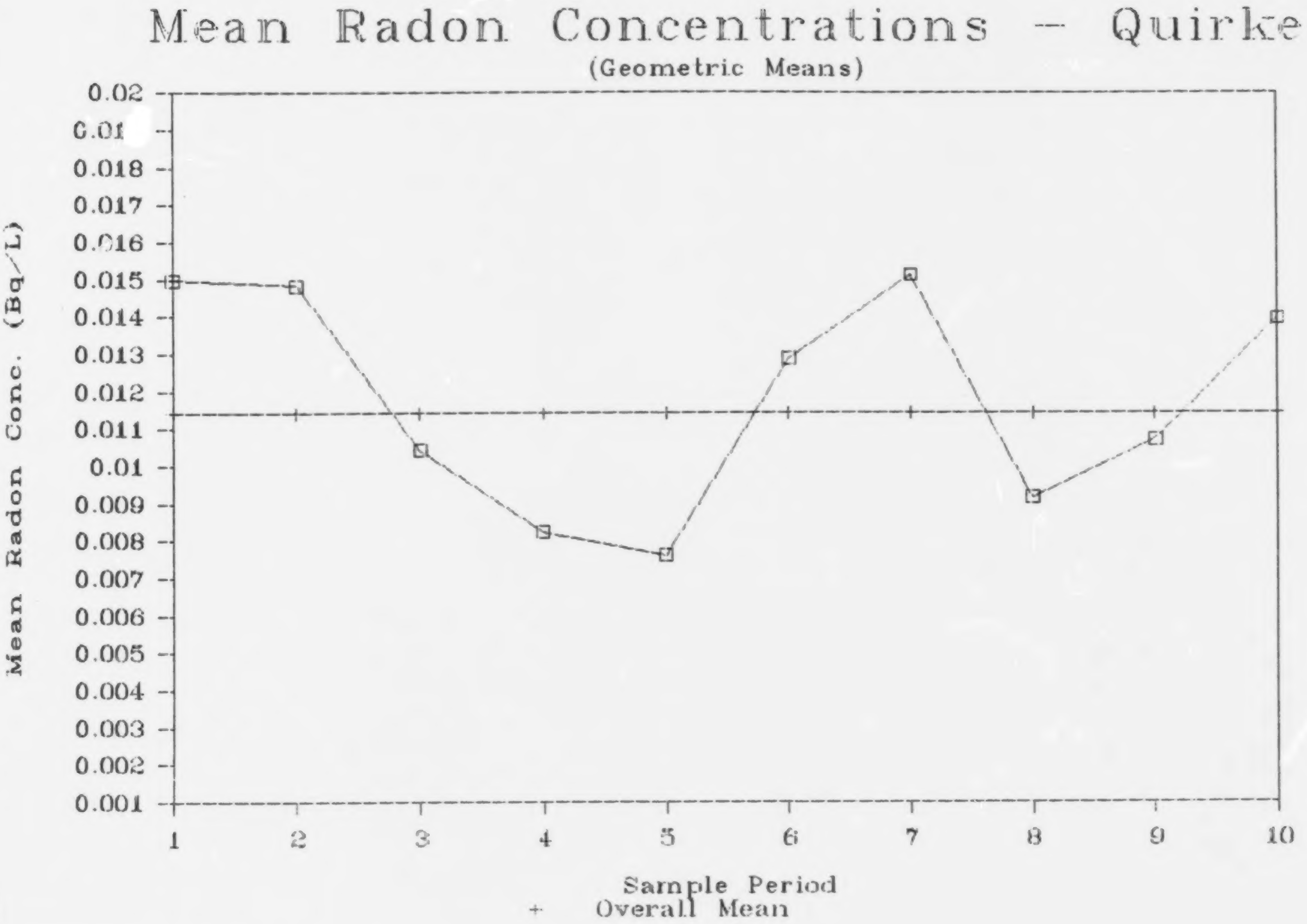

Mean Radon Concentrations – Quirke
(Geometric Means)
Mean Radon Conc. (Bq/L)
0.02
0.019
0.018
0.017
0.016
0.015
0.014
0.013
0.012
0.011
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
1
2
3
4
5
6
7
8
9
10
Sample Period
+ Overall Mean

Table 6.9

Stanrock Tailings - Radon Monitor Station Location Summary

Station	Distance (m)*	Direction**	Comments
S1	1600	SW	Stanrock Road
S2	1100	SE	
S3	1500	SE	
S4	600	SE	Treatment Bldg.
S5	100	E	Dam A
S6	200	N	
S7	600	N	CANMET Mine
S8	100	W	Dam B
S9	700	W	
S10	50	S	Dam D Beaver Lake

* Distance to closest edge of the major portion of Stanrock tailings

** Direction of monitor from major portion of Stanrock tailings

A summary of the results for all ten of the Stanrock stations is presented on Table 6.10 and on Figure 6.5. The mean radon concentration for the Stanrock sites was 0.007 Bq/L (0.18 pCi/L) and ranged from a detected low of <0.001 Bq/L (0.02 pCi/L) at S9 to a high of 0.048 Bq/L (1.30 pCi/L) at S4.

The individual radon monitoring results for stations S1 to S10 are presented in the data sheets at the end of Chapter 7.

6.6 Elliot Lake Sites

Three radon monitoring sites were selected within the Town of Elliot Lake. The first site (EL1) was located at the Porridge Lake Pumping station in the southern part of town and was co-sited with the MOL radon daughter sampler. The second (EL2) site was located on the roof of the Municipal office and was also co-sited with a MOL radon daughter sampler. The third site (EL3) was located on the roof of the CAIRS facility.

A summary of the data for all three stations is presented in Table 6.11 and on Figure 6.6. The mean radon concentration measured in Elliot Lake was 0.005 Bq/L (0.13 pCi/L) and ranged from a minimum detected level of 0.002 Bq/L (0.05 pCi/L) at both EL2 and EL3 to a maximum level of 0.019 Bq/L (0.50 pCi/L) at EL2.

The individual Elliot Lake station results are presented in the data sheets at the end of Chapter 7.

6.7 Background Sites

Three background monitoring sites were selected for this study. The first station BKGD1 was located at Mississaugi Provincial Park, 25 km north of Elliot Lake. The second station BKGD2 was located in Blind River on the roof of the hospital. The third station BKGD3 was initially located at AECL's East Bull test facility 31 km north of Massey. With the winter closing of the facility the monitoring station was relocated to 1 km north of the

Table 6.10

Stanrock Tailings - Total Area Results Summary

Total Number of Results - 96

Total Number of S.N.S. Results - 25

Geometric Mean	0.007	Bq/L (0.18 pCi/L)
Geometric Std. Dev.	2.38	
Maximum Value	0.048	Bq/L (1.30 pCi/L)
Minimum Value	<0.001	Bq/L (0.02 pCi/L)

FIGURE 6.5

Mean Radon Concentrations – Stanrock

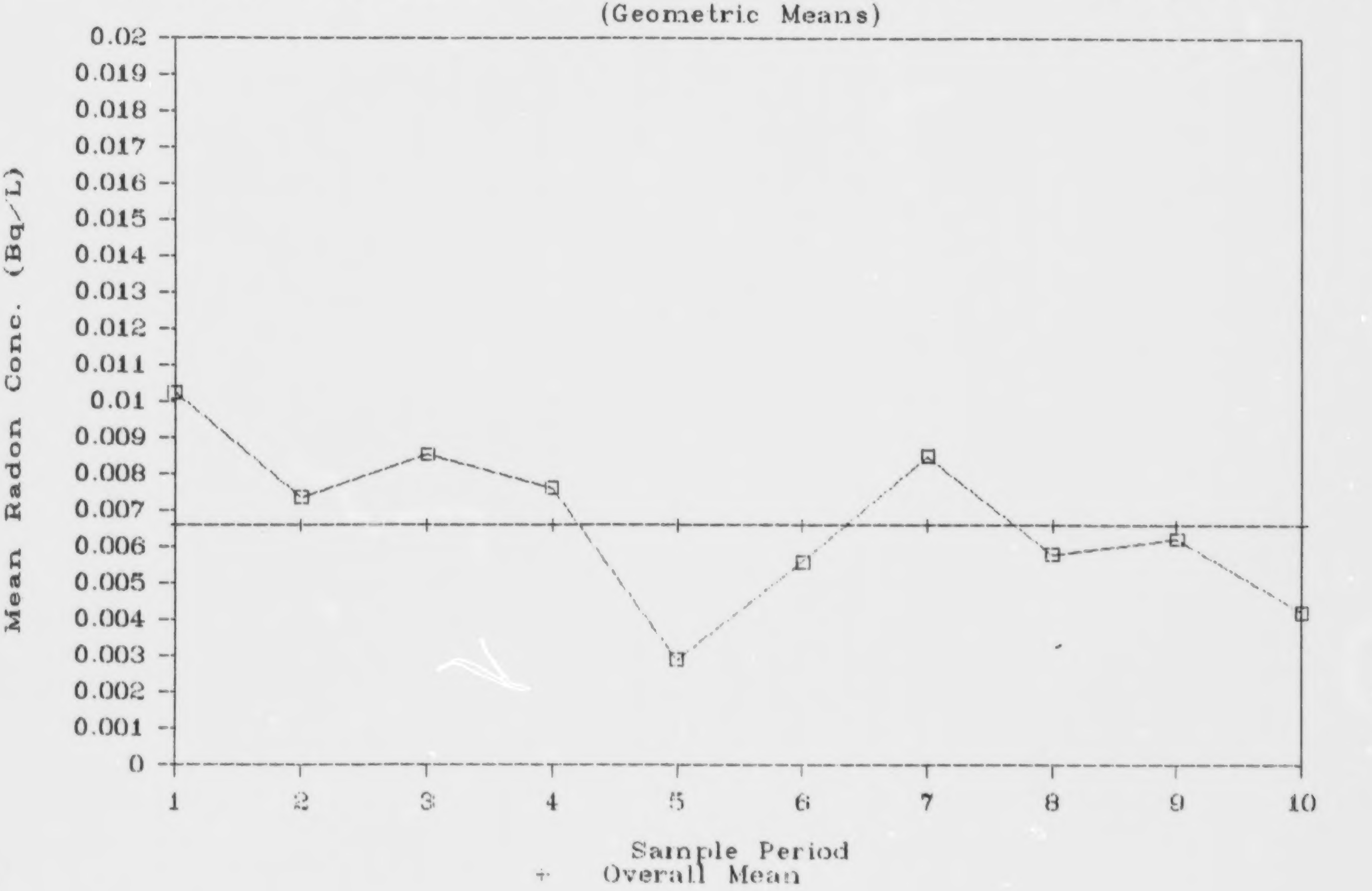


Table 6.11

Elliot Lake Sites - Total Area Results Summary

Total Number of Results - 25

Total Number of S.N.S. Results - 9

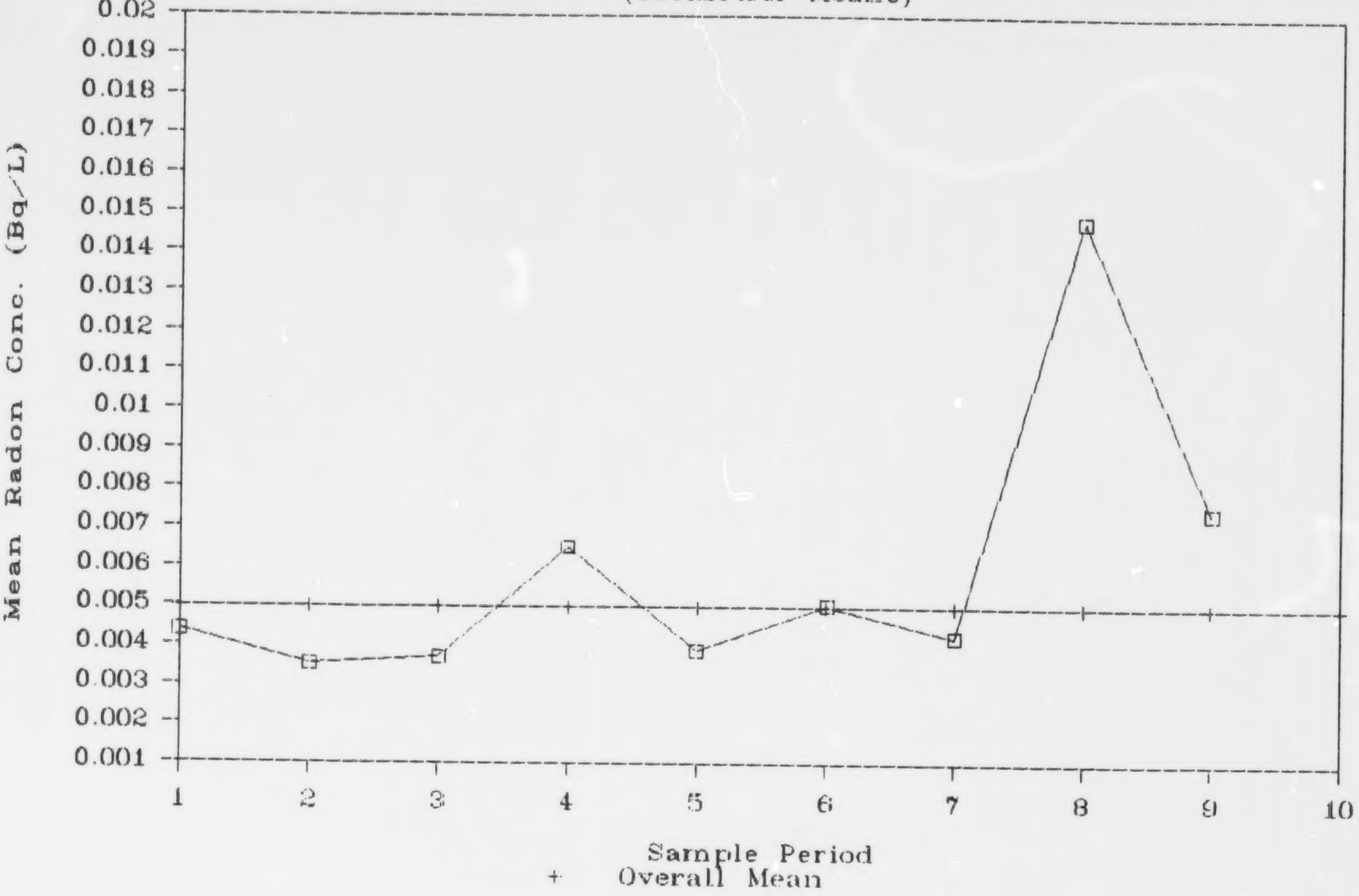
Geometric Mean	0.005 Bq/L (0.13 pCi/L)
Geometric Std. Dev.	1.85

Maximum Value	0.019	Bq/L (0.50 pCi/L)
Minimum Value	0.002	Bq/L (0.05 pCi/L)

FIGURE 6.6

Mean Radon Concentrations – Elliot Lake

(Geometric Means)



intersection of Highways #17 and #108.

A summary of the data for all three background stations is presented in Table 6.12 and on Figure 6.7. The mean radon concentration measured at the three background sites was 0.005 Bq/L (0.13 pCi/L) and ranged from a minimum detected level of 0.002 Bq/L (0.05 pCi/L) at BKGD2 and BKGD3 to a maximum level of 0.018 Bq/L (0.48 pCi/L) at BKGD1.

The median radon concentration measured by Eldorado at the Blind River site for 1984 was 0.027 Bq/L (0.73 pCi/L) with a range of 0.006 to 0.078 Bq/L (0.16 to 2.1 pCil/L). Measurements were made using Terradex detectors.

The individual background station results are presented in the data sheets at the end of Chapter 7.

6.8 Supplementary Radon Monitoring Program

A total of fifteen sites were included in the Terradex track-etch detector supplementary monitoring program. The results of this program are summarized in Table 6.13. The radon levels measured for the three and six month exposure period ranged from a low of 0.003 Bq/L (0.009 pCi/L) at EL3 to a high of 0.118 Bq/L (3.19 pCi/L) at Q3.

6.9 Ministry of Labour Radon Daughter Monitoring Program

As discussed in Section 2.5 the Ontario Ministry of Labour (MOL) has carried out radon daughter monitoring in the Elliot Lake area since June 1979.

It was the intent of the SENES radon monitoring study to co-site some of the radon monitors with MOL radon daughter monitors to assess any potential relationships. Table 6.14 presents the results for three stations: Municipal building in Elliot Lake (SENES Site EL2); Porridge Lake pumping station (SENES Site ELI); and Quirke Townsite (SENES Site Q2).

Table 6.12

Background Sites - Results Summary

Total Number of Results - 19

Total Number of S.N.S. Results - 8

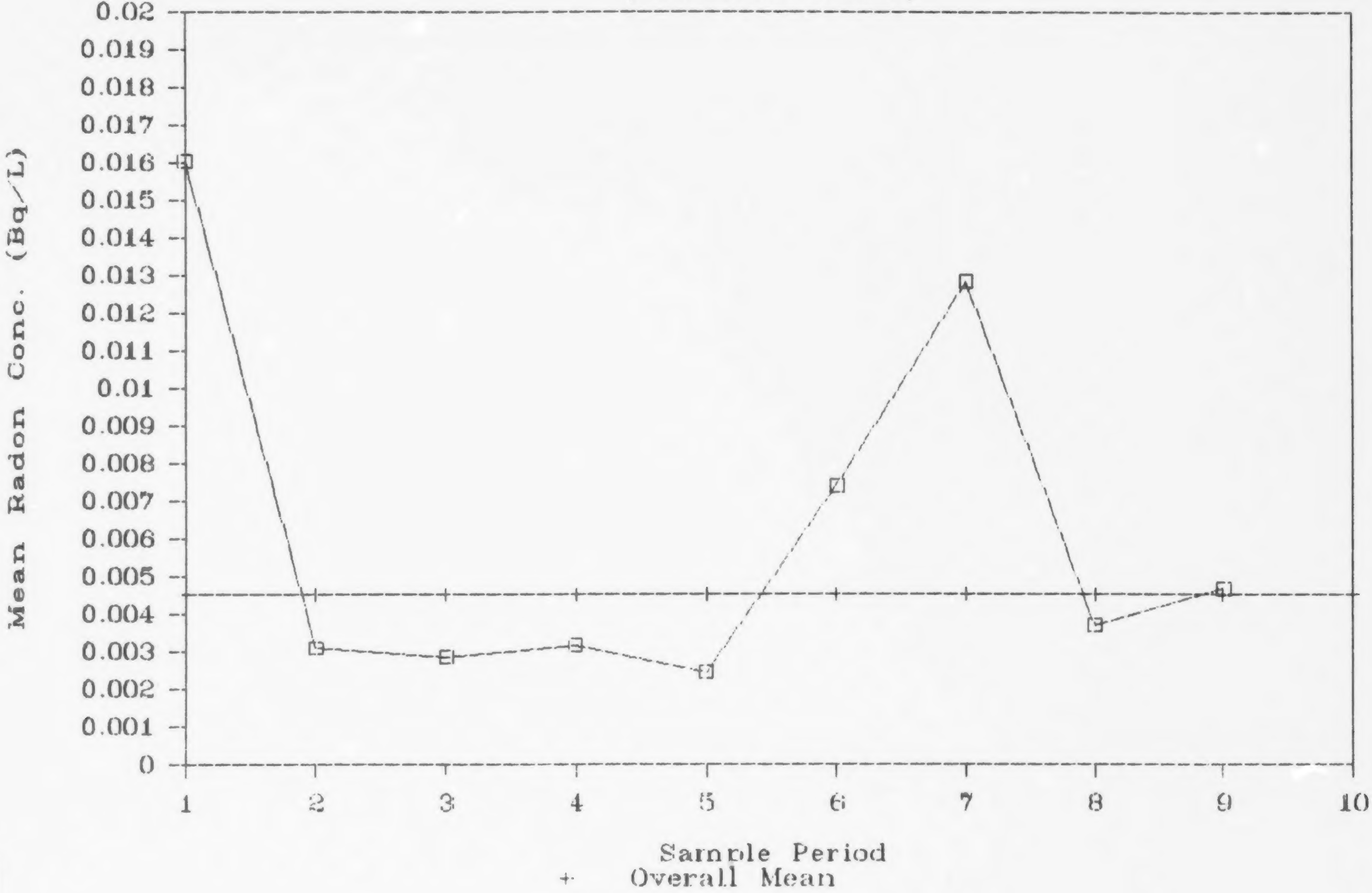
Geometric Mean	0.005 Bq/L (0.13 pCi/L)
Geometric Std. Dev.	2.12
Maximum Value	0.018 Bq/L (0.48 pCi/L)
Minimum Value	0.002 Bq/L (0.05 pCi/L)

Table 6.13

SUPPLEMENTARY RADON MONITORING PROGRAM RESULTS

			Terradex		R.A.D.	
			Radon Concentration		Radon Concentratio	
Tailings Area	Station	Monitoring Period	Bq/L	(pCi/L)	Bq/L	(pCi/L)
Crotch	C6	Oct 1 - Mar 22	0.014	(0.37)	0.009	(0.23)
		Mar 22 - not removed	site not accessible			
	C7	Oct 1 - Jan 17	0.008	(0.21)	<0.002	(<0.05)
		Jan 13 - Jun 19	0.011	(0.30)	0.012	(0.32)
Denison	D11	Oct 2 - Jan 10	0.017	(0.47)	0.005	(0.14)
		Jan 10 - Mar 15	0.004	(0.10)	0.021	(0.58
		Mar 15 - May 29	0.030	(0.80)	0.014	(0.38)
	D12	Oct 2 - Jan 10	0.017	(0.47)	0.004	(0.11)
		Jan 10 - May 29	0.072	(1.94)	0.006	(0.16)
Nordic	N2	Oct 1 - Jan 14	0.031	(0.84)	0.010	(0.26)
		Jan 14 - Jun 13	0.005	(0.13)	0.011	(0.31)
	N5	Oct 1 - Mar 22	0.026	(0.70)	0.009	(0.25)
		Mar 22 - Jun 13	0.030	(0.81)	0.015	(0.41)
	N7	Oct 1 - Jan 14	0.063	(1.71)	0.023	(0.63)
		Jan 14 - Mar 22	0.022	(0.59)	0.040	(1.09)
		Mar 22 - Jun 13	0.048	(1.29)	0.023	(0.63)
Quirke	Q3	Oct 1 - Jan 23	0.085	(2.29)	0.036	(0.96)
		Jan 23 - Mar 21	0.118	(3.19)	0.067	(1.8)
		Mar 21 - May 28	0.062	(1.68)	0.007	(0.18)
	Q4	Oct 1 - Jan 23	0.034	(0.92)	0.014	(0.37)
		Jan 23 - May 28	0.030	(0.80)	0.012	(0.33)
	Q6	Sep 19 - Mar 21	0.008	(0.21)	0.009	(0.25)
		Mar 21 - May 28	0.014	(0.39)	0.002	(0.05)
Stanrock	S5	Oct 2 - Mar 15	0.009	(0.24)	0.005	(0.14)
		Mar 15 - Jun 12	0.017	(0.45)	0.006	(0.16)
	S8	Oct 2 - Mar 15	0.011	(0.29)	0.007	(0.20)
		Mar 15 - Jun 12	0.014	(0.37)	0.002	(0.06)
	S10	Oct 2 - Jan 10	0.017	(0.47)	0.006	(0.16)
		Jan 10 - Mar 15	0.019	(0.52)	<0.003	(<0.1)
		Mar 15 - Jun 12	0.014	(0.37)	0.007	(0.19)
Elliot Lake	EL3	Sep 20 - Jan 13	0.010	(0.27)	0.002	(0.05)
		Jan 13 - Mar 20	0.003	(0.09)	0.004	(0.10)
		Mar 20 - May 31	0.007	(0.18)	0.005	(0.13)
Background	BKGD3	Sep 24 - Jan 20	0.015	(0.40)	0.003	(0.07)
		Jan 20 - May 23	0.014	(0.38)	0.006	(0.15)

FIGURE 6.7



Mean Radon Concentrations – Background

(Geometric Means)

The radon daughter concentrations measured at the three sites range from a low of 0.007, at both the EL1 and EL2 sites, to a high of 0.017 WL at Q2. The concentrations measured at the Quirke Townsite monitoring location were generally higher than the levels measured at the other two sites.

Because MOL monitoring periods do not correspond exactly with those for the SENES radon monitors it is difficult to calculate precise equilibrium ratios between radon daughter levels and radon concentrations. In addition data for several monitoring periods were not available as noted in the table.

Table 6.14

MOL RADON DAUGHTER MONITORING RESULTS

Site	Exposure Period	Radon Daughter Concentration (WL)
EL1	84/07/04 - 84/08/08	0.002
(Porridge Lake)	84/08/08 - 84-09/12	0.002
	84/09/12 - 84/10/17	0.002
	84/10/17 - 84/11/21	0.001
	84/11/21 - 84/12/28	0.001
	84/21/28 - 85/01/03	0.003
	85/01/03 - 85/02/06	0.001
	85/02/06 - 85/03/13	0.0008
	85/03/20 - 85/04/24	0.0008
	85/04/24 - 85/05/22	0.0007
EL2	84/05/03 - 84/06/06	0.0007
(Municipal Building)	84/06/06 - 84/07/11	0.001
	84/07/11 - 84/08/29	N/D
	84/08/29 - 84/10/03	0.002
	84/10/03 - 84/11/07	0.001
	84/11/07 - 84/12/12	N/D
	84/12/12 - 85/01/16	0.0007
	85/01/16 - 85/02/20	0.0004
	85/02/20 - 85/03/13	N/D
	85/03/13 - 85/04/10	0.001
	85/04/10 - 85/05/01	0.0007
	85/05/01 - 85/05/29	N/D
	85/05/29 - 85/06/12	0.003
Q2	84/05/31 - 84/07/04	0.009
(Quirke Townsite)	84/07/04 - 84/08/08	0.009
	84/08/08 - 84/09/12	0.017
	84/09/12 - 84/10/17	0.008
	84/10/17 - 84/11/21	0.002
	84/11/21 - 84/12/28	0.0012
	84/12/28 - 85/01/30	0.002
	85/01/30 - 85/02/06	N/D
	85/02/06 - 85/03/13	0.003
	85/03/13 - 85/04/17	0.001
	85/04/17 - 85/05/22	0.003

Note
N/D - Denotes no data

7.0 DISCUSSION OF RADON MONITOR RESULTS

7.1 Overview

As described in section 4.1 the ambient radon levels were measured using prototype R.A.D. E1 time averaging electrostatically enhanced environmental radon monitors. These monitors were selected for this project because of:

- their ability to provide good counting statistics for low ambient radon levels over short exposure periods (30 days);
- the geometry of the diffusion chamber which enabled differentiation of the radon tracks from spurious tracks;
- their ability to survive harsh winter conditions; and
- their selectivity for only radon and not thoron.

The monitors were calibrated prior to their installation in the field and following the twelve month monitoring period. It was after the second calibration that a deformation of the circular track pattern (shown on Figure 4.1) was identified on some detector chips. Further investigations by the supplier revealed that this deformation arose from a non-systematic altering of the electric field within the diffusion chamber. As a result the tracks were distributed over a larger area so that scanning of nine fields was not enough. This deformation in track pattern was only significant for low track densities, and for higher levels of radon (greater than 0.02 Bq/L) the tracks were found to be still concentrated in the nine squares.

As a result of this experience the supplier has made further adjustments and modifications to the E-1 monitor to stabilize the electric field and calibration.

In view of the foregoing it should be recognized that there is some uncertainty associated with the measurements arizing from a variety of factors including track density, power levels, exposure period etc. Nonetheless the results are believed to be indicative of actual levels.

The principal conclusion of this study is that ambient levels of radon are quite low, even directly over tailings, and that ambient levels drop rapidly to background with increasing distance from tailings.

Some further details on the monitoring results are presented in the following sections.

7.2 Off-Tailings Sites

Figure 7.1 presents a histogram of the data distribution for the site off but in close proximity to tailings. In the figure over 95% of the data are less than 0.04 Bq/L (approximately 1 pCi/L), while over 60% of the data are less than 0.01 Bg/L (approximately 0.2 pCi/L) approximately.

The data collected at the tower sites have not been included in this distribution and are discussed in Section 7.4 as on-tailings sites.

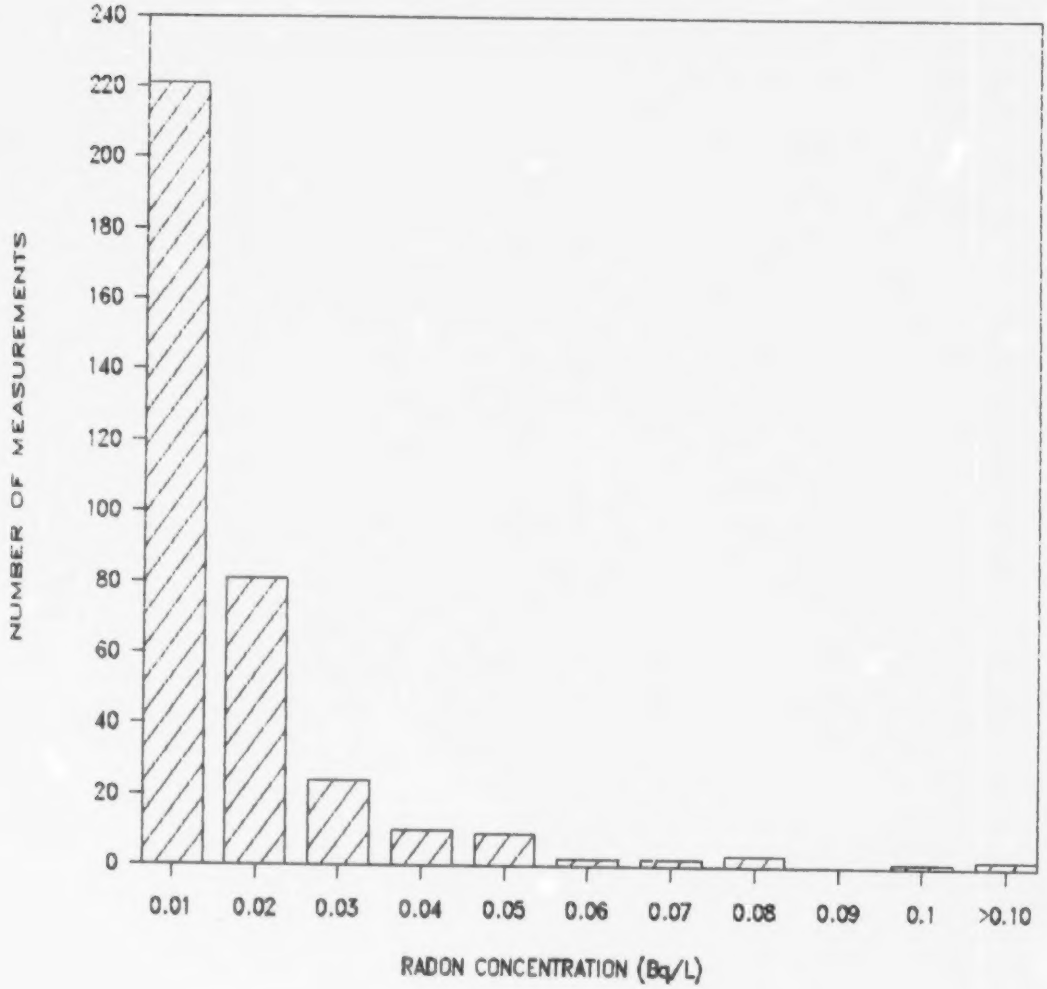
A total of 475 samples were collected at the off-tailings sites of which 120 have been treated as statistically not significant (SNS) readings. These SNS readings are not included in Figure 7.1 nor in the summary of statistics presented below:

Data Summary for Off-Tailings Sites

Number of data points	355
Geometric mean	0.008 Bq/L (0.22 pCi/L)
Geometric Std. Dev.	2.51
Lowest value	0.0003 Bq/L (0.01 pCi/L)
Highest value	0.146 Bq/L (3.94 pCi/L)
Median	0.008 Bq/L (0.21 pCi/L)

FIGURE 7.1

DISTRIBUTION OFF-TAILINGS RADON RESULTS



7.3 Background and Elliot Lake Sites

Figure 7.2 presents a histogram of the data distribution for the background and Elliot Lake sites. As shown in the figure all of the data were less than 0.020 Bg/L (0.5 pCi/L). A total of 52 samples were collected for the two areas, of which 17 were SNS readings. These SNS readings are not included in Figure 7.2 nor in the summary of statistics presented below:

Data Summary for Background and Elliot Lake Sites

Number of data points	35
Geometric mean	0.005 Bq/L (0.14 pCi/L)
Geometric std. dev.	2.03
Lowest value	0.002 Bq/L (0.05 pCi/L)
Highest value	0.019 Bq/L (0.5 pCi/L)
Median	0.005 Bq/L (0.13 pCi/L)

Based on comparison of the above statistics, the off-tailings were on average 60% higher than the background and Elliot Lake sites. Nonetheless the radon levels measured were quite low for both groups of sites.

7.4 On-Tailings Tower Sites

Figures 7.3 and 7.4 present the data distribution with height for both the Nordic and Quirke on-tailings tower sites. A total of 40 samples were collected for each tower site, of which 9 were SNS readings for each of the Nordic and Quirke towers. These SNS readings are not included in the figures nor in the summary of statistics presented below:

FIGURE 7.2

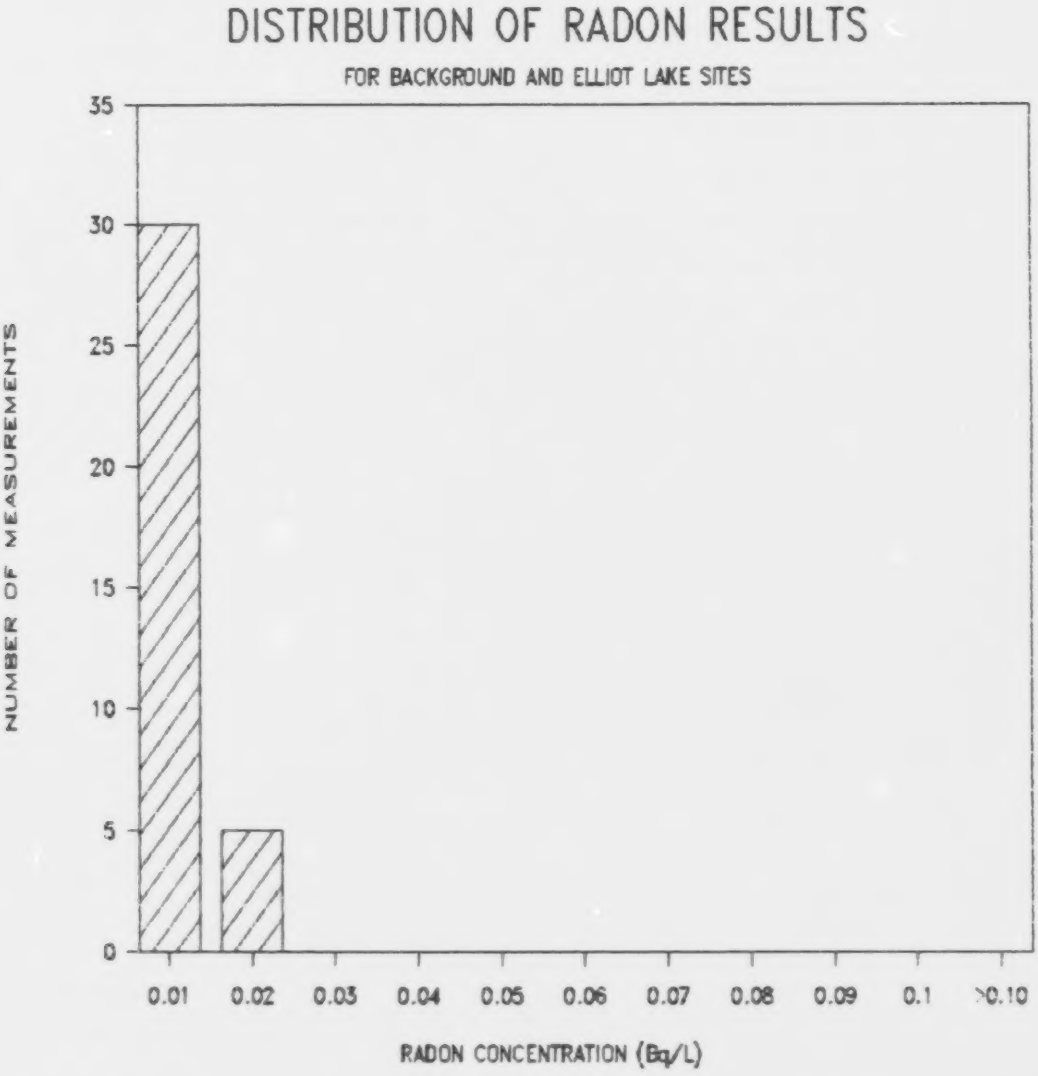

DISTRIBUTION OF RADON RESULTS
FOR BACKGROUND AND ELLIOT LAKE SITES
35
30
25
20
15
10
5
0
NUMBER OF MEASUREMENTS
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
>0.10
RADON CONCENTRATION (Bq/L)

FIGURE 7.3

RADON WITH HEIGHT –NORDIC TOWER

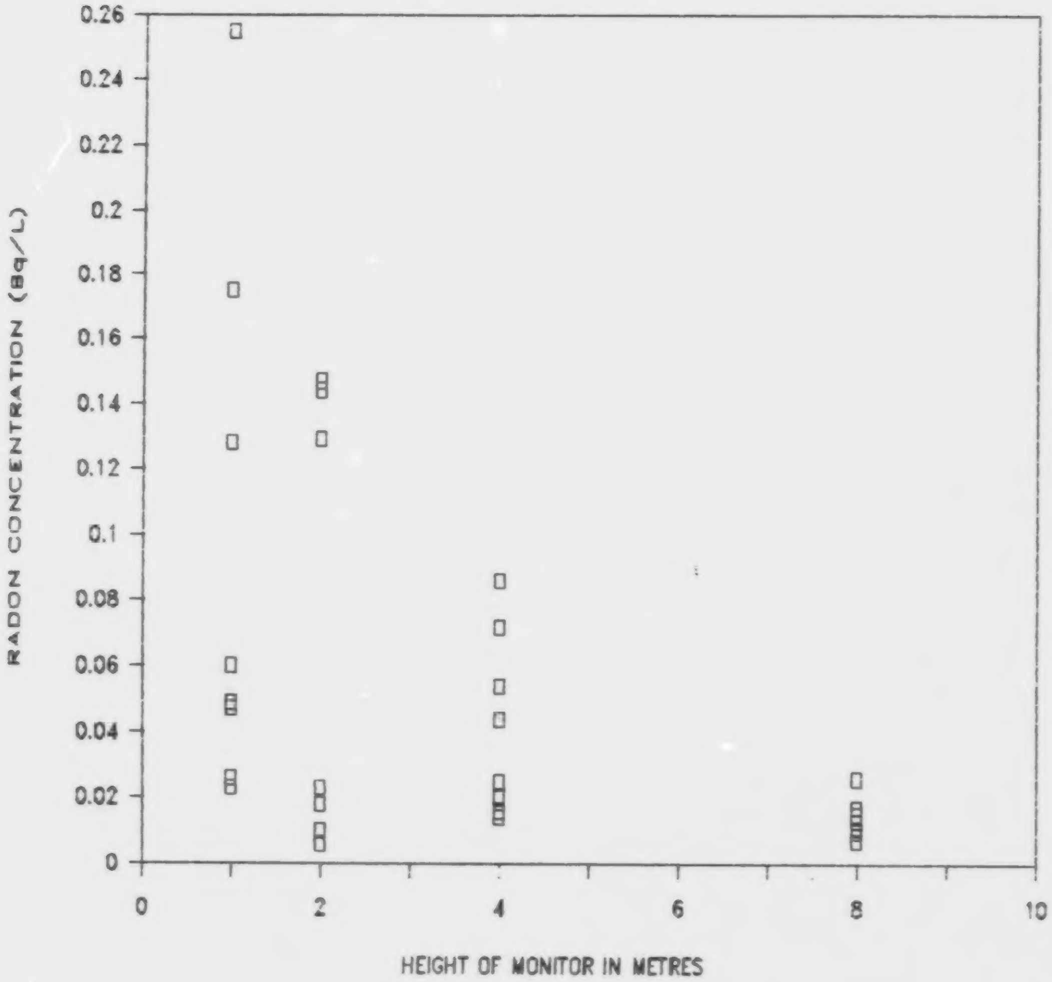
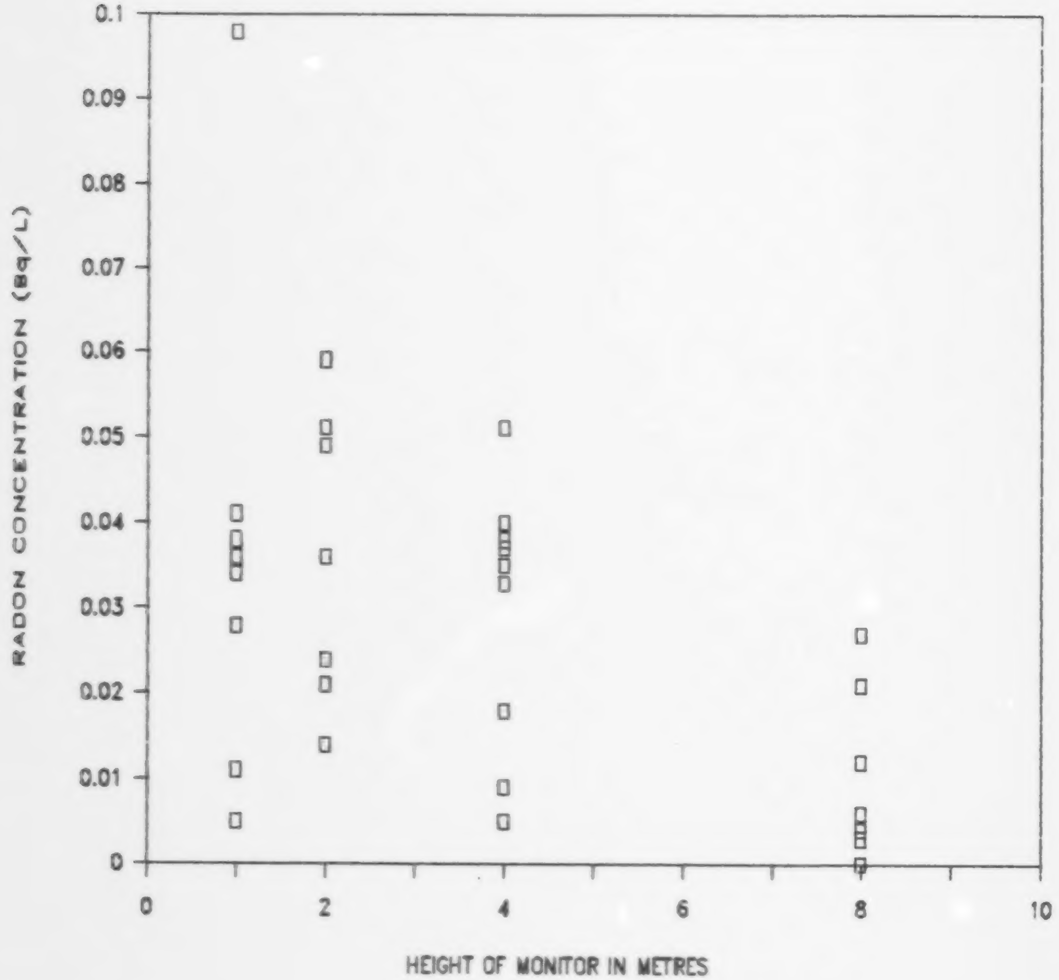


FIGURE 7.4

RADON WITH HEIGHT -QUIRKE TOWER



Data Summary for Nordic and Quirke Tower Sites

	Nordic (all heights)	Quirke (all heights)
Number of data points	31	31
Geometric means	0.032 Bq/L (0.8 > pCi/L)	0.022 Bq/L (0.60 pCi/L)
Geometric std. dev.	2.8	2.4
Lowest value	0.006 Bq/L (0.15 pCi/L)	0.003 Bq/L (0.09 pCi/L)
Highest value	0.255 Bq/L (6.89 pCi/L)	0.098 Bq/L (2.64 pCi/L)
Median	0.025 Bq/L (0.68 pCi/L)	0.033 Bq/L (0.9 pCi/L)

Based on the above statistics the radon concentrations at the inactive and vegetated Nordic Tower site, on average, were 45% higher than the radon concentration measured at the active an partially vegetated Quirke Tower site.

With respect to the distribution of radon with height Table 7.1 presents a summary of the results of the data collected at the heights of 1m, 2m, 4m, and 8m for the Nordic and Quirke Towers respecitvely. A review of this Table and Figures 7.3 and 7.4 suggests a decreasing radon concentration with increasing height above the surface of the tailings.

Table 7.1

STATISTICS FOR NORDIC AND QUIRKE TOWER RADON RESULTS

			Radon Concentration (Bq/L)			
Location	Height (m)	Number of Samples	Geometric Mean	G.M. Stnd. Dev.	Min.	Max.
Nordic Tower	1	8	0.068	2.41	0.023	0.255
" "	2	7	0.035	3.89	0.006	0.147
" "	4	8	0.037	2.01	0.014	0.086
" "	8	8	0.014	1.49	0.007	0.026
Quirke Tower	1	8	0.027	2.47	0.005	0.098
" "	2	8	0.033	1.65	0.014	0.059
" "	4	9	0.024	2.20	0.005	0.051
" "	8	7	0.008	2.30	0.003	0.027

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DATA SHEETS

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5141500
Easting :374200

STATION: C1

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.004 (0.1)	Mean Exposure Period:	37
Max. Radon Level:	0.007 (0.18)	Max. Exposure Period:	54
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	26

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	56	84/06/14	84/07/10	26	0.1	.004
2	56	84/07/10	84/08/14	35	<0.1	<.004
3	56	84/08/14	84/09/17	34	<0.1	<.004
4	56	84/09/17	84/10/31	44	0.18	.007
5	56	84/10/31	84/12/18	48	0.05	.002
6	89	84/12/18	85/01/16	29	*	*
7	83	85/01/16	85/02/19	34	*	*
8	83	85/02/19	85/03/22	31	0.16	.006
9	83	85/03/22	85/05/15	54	0.05	.002
10	83	85/05/15	85/06/19	35	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	56	good	n	good	
2	56	1 dead	y	good	changed 1 battery
3	56	1 dead	y	good	changed 1 battery
4	56	1 low	y	good	changed 1 battery
5	56	good	n	good	
6	89		n	good	wb Dec.18
7	83	low	y	good	new batteries
8	83	low	y	good	new batteries
9	83	low	y	low	new batteries
10	83	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5140500
Easting :375600

STATION: C2

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.007 (0.19)	Mean Exposure Period:	36.9
Max. Radon Level:	0.018 (0.49)	Max. Exposure Period:	54
Min. Radon Level:	0.001 (0.03)	Min. Exposure Period:	26

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	39	84/06/14	84/07/10	26	0.16	.006
2	39	84/07/10	84/08/13	34	0.49	.018
3	39	84/08/14	84/09/17	34	0.32	.012
4	39	84/09/17	84/10/31	44	0.39	.014
5	39	84/10/31	84/12/18	48	0.08	.003
6	7	84/12/18	85/01/16	29	0.36	.013
7	7	85/01/16	85/02/27	42	0.23	.009
8	7	85/02/27	85/03/22	23	*	*
9	7	85/03/22	85/05/15	54	0.03	.001
10	7	85/05/15	85/06/19	35	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	39	good	n	good	
2	39	1 low	y	good	1 battery changed
3	39	1 low	y	good	1 battery changed
4	39	1 low	y	good	1 battery changed
5	39		n	good	wb Dec.18
6	7	fair	y	good	2 new batteries
7	7	low	y	good	new batteries
8	7	low	y	good	new batteries
9	7	low	y	low	new batteries
10	7	fair			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5141300
Easting :375500

STATION: C3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.006 (0.16)	Mean Exposure Period:	37
Max. Radon Level:	0.010 (0.26)	Max. Exposure Period:	54
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	26

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON	
					pCi/L	Bq/L
1	32	84/06/14	84/07/10	26	0.26	.010
2	32	84/07/10	84/08/13	34	*	*
3	32	84/08/13	84/09/17	35	*	*
4	32	84/09/17	84/10/31	44	<0.05	<.002
5	32	84/10/31	84/12/18	48	*	*
6	32	84/12/18	85/01/16	29	0.11	.004
7	32	85/01/16	85/02/19	34	0.22	.008
8	32	85/02/19	85/03/22	31	0.15	.006
9	32	85/03/22	85/05/15	54	0.21	.008
10	32	85/05/15	85/06/19	35	0.24	.009

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	32	both low	y	low	changed 2 batteries
2	32	good	n	good	
3	32	1 dead	n	good	new board HV 1250
4	32	1 d 1 low	n	good	charge not holding
5	32	good	n	good	wb Dec.18
6	32	low	y	good	2 new batteries
7	32	low	y	good	new batteries
8	32	low	y	low	new batteries
9	32	low	y	low	new batteries
10	32	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5142000
Easting :375600

STATION: C4

SUMMARY STATISTICS

	Bq/L (pCi/L)			Days
Mean Radon Level:	0.023	(0.62)	Mean Exposure Period:	41.1
Max. Radon Level:	0.028	(0.76)	Max. Exposure Period:	69
Min. Radon Level:	0.016	(0.44)	Min. Exposure Period:	26

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	8	84/06/14	84/07/10	26	*	*
2	8	84/07/10	84/09/17	69	*	*
3	30	84/09/17	84/10/31	44	0.76	.028
4	30	84/10/31	84/12/18	48	*	*
5	56	84/12/18	85/01/16	29	0.6	.022
6	56	85/01/16	85/02/19	34	0.58	.021
7	56	85/02/19	85/03/22	31	0.72	.027
8	56	85/03/22	85/05/15	54	0.44	.016
9	56	85/05/15	85/06/19	35	0.68	.025

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	8	both low	y	low	changed both battreies
2	8	good	n	good	not accesible until Sept.
3	30	1 d 1 low	n	good	
4	30	good	n	good	wb Dec.18
5	56	fair	y	good	2 new batteries
6	56	low	y	good	new batteries
7	56	low	y	good	new batteries
8	56	low	y	low	new batteries
9	56	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5142200
Easting :376300

STATION: C5

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.006 (0.15)	Mean Exposure Period:	37
Max. Radon Level:	0.011 (0.3)	Max. Exposure Period:	54
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	48	84/06/14	84/07/10	26	<0.1	<.004
2	48	84/07/10	84/08/13	34	0.29	.011
3	48	84/08/13	84/09/17	35	0.12	.004
4	48	84/09/17	84/10/31	44	*	*
5	48	84/10/31	84/12/18	48	0.11	.004
6	18	84/12/18	85/01/16	29	<0.05	<.002
7	34	85/01/16	85/02/19	34	0.17	.006
8	34	85/02/19	85/03/22	31	0.28	.010
9	34	85/03/22	85/05/15	54	0.17	.006
10	34	85/05/15	85/06/19	35	0.3	.011

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	48	good	n	good	
2	48	2 low	y	good	changed 2 batteries
3	48	good	n	good	
4	48	2 low	n	good	contaminated
5	48	good	n	good	wb Dec.18
6	18	low	n	low	new inst. #34
7	34	low	y	good	new batteries
8	34	low	y	good	new batteries
9	34	very low	y	good	new batteries
10	34	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5141700
Easting :376300

STATION: C6

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.009 (0.25)	Mean Exposure Period:	36.8
Max. Radon Level:	0.024 (0.64)	Max. Exposure Period:	54
Min. Radon Level:	0.004 (0.1)	Min. Exposure Period:	25

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	17	84/06/15	84/07/10	25	< 0.1	<.004
2	17	84/07/10	84/08/14	35	0.64	.024
3	17	84/08/14	84/09/17	34	0.37	.014
4	17	84/09/17	84/10/31	44	0.25	.009
5	17	84/10/31	84/12/18	48	0.16	.006
6	30	84/12/18	85/01/16	29	0.15	.006
7	30	85/01/17	85/02/19	33	0.37	.014
8	46	85/02/19	85/03/22	31	*	*
9	45	85/03/22				
10	45					

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	17	good	n	good	
2	17	2 low	y	good	changed 2 batteries
3	17	good	n	good	
4	17	good	n	good	
5	17	good	n	good	wb Dec.18
6	30	low	n	low	just repaired
7	30	low	n	good	wire broken, changed to #45
8	45	low	n	low	
9	45				not accesible
10	45				not accesible

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5141400
Easting :376600

STATION: C7

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.005 (0.14)	Mean Exposure Period:	36.8
Max. Radon Level:	0.026 (0.7)	Max. Exposure Period:	54
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	26

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	45	84/06/14	84/07/10	26	*	*
2	45	84/07/10	84/08/14	34	*	*
3	45	84/08/14	84/09/17	34	0.16	.006
4	45	84/09/17	84/10/31	44	<0.05	<.002
5	45	84/10/31	84/12/18	48	<0.05	<.002
6	45	84/12/18	85/01/17	30	*	*
7	45	85/01/17	84/02/19	33	*	*
8	10	85/02/20	85/03/22	30	0.1	.004
9	10	85/03/22	85/05/15	54	0.41	.015
10	10	85/05/15	85/06/19	35	0.7	.026

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	45	both low	y	low	changed both batteries
2	45	good	n	good	
3	45	1 dead	n	good	new board HV=1050
4	45	good	n	good	
5	45	good	n	good	wb Dec.18
6	45	low	n	good	
7	45	low	n	low	new inst. #10
8	10	good	y	good	new batteries
9	10	low	y	good	new batteries
10	10	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: CROTCH

LOCATION: Northing:5141400
Easting :377800

STATION: C8

SUMMARY STATISTICS

	Bq/L	(pCi/L)
Mean Radon Level:	0.005	(0.14)
Max. Radon Level:	0.010	(0.26)
Min. Radon Level:	0.002	(0.05)

	Days
Mean Exposure Period:	37
Max. Exposure Period:	54
Min. Exposure Period:	26

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	18	84/06/14	84/07/10	26	0.1	.004
2	18	84/07/10	84/08/14	35	0.12	.004
3	18	84/08/14	84/09/17	34	<0.1	<.004
4	18	84/09/17	84/10/31	44	0.26	.010
5	18	84/10/31	84/12/18	48	*	*
6	39	84/12/18	85/01/17	30	0.14	.005
7	39	85/01/17	85/02/19	33	0.21	.008
8	39	85/02/19	85/03/22	31	*	*
9	39	85/03/22	85/05/15	54	0.05	.002
10	39	85/05/15	85/06/19	35	0.24	.009

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	18	good	n	good	
2	18	good	n	good	
3	18	1 low	n	good	
4	18	good	n	good	
5	18	good	n	good	wb Dec.18
6	39	low	n	good	
7	39	low	y	low	new batteries
8	39	low	y	low	new batteries
9	39	low	y	nil	new batteries
10	39	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5150100
Easting :374100

STATION: D1

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.004 (0.12)	Mean Exposure Period:	35
Max. Radon Level:	0.008 (0.21)	Max. Exposure Period:	49
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	27

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	25	84/06/13	84/07/12	29	<0.1	<.004
2	25	84/07/12	84/08/14	33	*	*
3	25	84/08/14	84/10/02	49	*	*
4	25	84/10/02	84/10/29	27	0.21	.008
5	25	84/10/29	84/11/29	31	0.05	.002
6	25	84/11/29	85/01/04	36	0.11	.004
7	25	85/01/04	85/02/04	31	0.2	.007
8	25	85/02/04	85/03/15	39	*	*
9	25	85/03/15	85/04/23	39	*	*
10	25	85/04/23	85/05/29	36	0.13	.005

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	25	1 low	y	good	changed 1 battery
2	25	1 low	y	good	changed 1 battery
3	25	good	n	good	
4	25	good	n	good	
5	25	good	n	good	wb Nov.29
6	25	pack low	y	good	changed 2 at 9v.
7	25	low	y	low	new batteries
8	25	low	y	good	new batteries
9	25	low	y	good	new batteries
10	25	low		low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5150100
Easting :375400

STATION: D2

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.006	(0.17)	Mean Exposure Period:	35
Max. Radon Level:	0.017	(0.46)	Max. Exposure Period:	47
Min. Radon Level:	0.001	(0.03)	Min. Exposure Period:	26

Number of SNS* Readings: 5

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	4	84/06/13	84/07/12	29	*	*
2	4	84/07/12	84/08/16	35	*	*
3	7	84/08/16	84/10/02	47	*	*
4	7	84/10/02	84/10/30	28	*	*
5	7	84/10/30	84/12/12	43	*	*
6	35	84/12/12	85/01/10	29	0.3	.011
7	35	85/01/10	85/02/05	26	0.46	.017
8	35	85/02/05	85/03/15	38	0.12	.004
9	35	85/03/15	85/04/23	39	0.03	.001
10	35	85/04/23	85/05/29	36	0.26	.010

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	4	both low	y	low	changed 2 batteries
2	4	good	n	good	changed to inst. #7 HV-1380
3	7	good	n	good	
4	7	1 dead	n	good	
5	7	good	n	good	wb Dec.12
6	35	fair	n	good	
7	35	low	y	good	new batteries
8	35	dead	y	none	new batteries
9	35	low	n	nil	
10	35	good	n	nil	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5150000
Easting :376200

STATION: D3

SUMMARY STATISTICS

	Bq/L (pCi/L)			Days
Mean Radon Level:	0.005	(0.13)	Mean Exposure Period:	35
Max. Radon Level:	0.010	(0.28)	Max. Exposure Period:	43
Min. Radon Level:	0.002	(0.05)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	2	84/06/13	84/07/12	29	<0.1	<.004
2	2	84/07/12	84/08/16	35	<0.1	<.004
3	2	84/08/16	84/09/18	33	0.17	.006
4	2	84/09/18	84/10/30	42	0.28	.010
5	2	84/10/30	84/12/12	43	0.16	.006
6	23	84/12/12	85/01/10	29	0.05	.002
7	23	85/01/10	85/02/05	26	0.26	.010
8	23	85/02/05	85/03/15	38	<0.1	<.004
9	23	85/03/15	85/04/23	39	*	*
10	84	85/04/23	85/05/29	36	0.12	.004

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	2	good	n	good	
2	2	1 low	y	good	1 battery changed
3	2	1 low	y	good	1 battery changed
4	2	good	n	good	
5	2	good	n	good	wb Dec.12
6	23	fair	y	good	new pack
7	23	low	y	good	new batteries
8	23	low	y	good	new batteries
9	23	low	n	nil	new inst. #84
10	84	near dead	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5149600
Easting :377400

STATION: D4

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.007 (0.18)	Mean Exposure Period:	35
Max. Radon Level:	0.023 (0.63)	Max. Exposure Period:	47
Min. Radon Level:	0.004 (0.1)	Min. Exposure Period:	23

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	11	84/06/13	84/07/12	29	0.14	.005
2	11	84/07/12	84/08/16	35	<0.1	<.004
3	11	84/08/16	84/10/02	47	0.22	.008
4	11	84/10/02	84/10/30	28	*	*
5	11	84/10/30	84/12/12	43	*	*
6	82	84/12/12	85/01/04	23	0.15	.006
7	82	85/01/04	85/02/05	32	0.63	.023
8	82	85/02/05	85/03/15	38	*	*
9	82	85/03/15	85/04/23	39	*	*
10	87	85/04/23	85/05/29	36	0.12	.004

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	11	good	n	good	
2	11	2 dead	y	good	changed 2 batteries
3	11	good	n	good	
4	11	1 dead 1L	y	good	changed 2 batteries
5	11	good	n	good	wb Dec.12
6	82	fair	y	good	changed 2 batteries
7	82	low	y	good	changed 2 batteries
8	82	low	y	low	changed 2 batteries
9	82	good	n	nil	new inst. #87
10	87	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5148200
Easting :377700

STATION: D5

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.007 (0.20)	Mean Exposure Period:	38.9
Max. Radon Level:	0.012 (0.33)	Max. Exposure Period:	60
Min. Radon Level:	0.004 (0.1)	Min. Exposure Period:	29

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	42	84/06/13	84/07/12	29	<0.1	<.004
2	42	84/07/12	84/08/16	35	*	*
3	42	84/08/16	84/09/18	33	0.23	.009
4	42	84/09/18	84/11/05	48	0.13	.005
5	42	84/11/05	85/01/04	60	*	*
6	81	85/01/04	85/02/14	41	0.22	.008
7	81	85/02/14	85/03/15	29	*	*
8	81	85/03/15	85/04/23	39	0.26	.010
9	81	85/04/23	85/05/29	36	0.33	.012

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	42	good	n	good	
2	42	2 low	y	good	changed 2 batteries
3	42	good	n	good	
4	42	good	n	good	
5	42	fair	n	good	wb Jan.4
6	81	low	y	good	new batteries
7	81	low	y	good	new batteries
8	81	low	y	good	new batteries
9	81	very low	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5147900
Easting :378200

STATION: D6

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.010 (0.28)	Mean Exposure Period:	38.9
Max. Radon Level:	0.023 (0.61)	Max. Exposure Period:	60
Min. Radon Level:	0.005 (0.13)	Min. Exposure Period:	29

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	54	84/06/13	84/07/12	29	0.14	.005
2	54	84/07/12	84/08/16	35	*	*
3	54	84/08/16	84/10/02	47	*	*
4	54	84/10/02	84/11/05	34	0.21	.008
5	54	84/11/05	85/01/04	60	*	*
6	9	85/01/04	85/02/14	41	0.61	.023
7	9	85/02/14	85/03/15	29	0.36	.013
8	9	85/03/15	85/04/23	39	0.52	.019
9	9	85/04/23	85/05/29	36	0.13	.005

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	54	good	n	good	
2	54	2 low	y	good	changed 2 batteries
3	54	good	n	good	
4	54	good	n	good	
5	54	good	n	good	wb Jan.4
6	9	low	y	good	new batteries
7	9	low	y	nil	new batteries
8	9	low	y	good	new batteries
9	9	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5146900
Easting :376800

STATION: D7

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.005	(0.13)	Mean Exposure Period:	38.9
Max. Radon Level:	0.014	(0.38)	Max. Exposure Period:	60
Min. Radon Level:	0.001	(0.04)	Min. Exposure Period:	29

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	36	84/06/13	84/07/12	29	0.14	.005
2	36	84/07/12	84/08/14	33	<0.1	<.004
3	36	84/08/14	84/09/18	35	0.17	.006
4	36	84/09/18	84/11/05	48	0.06	.002
5	36	84/11/05	85/01/04	60	0.04	.001
6	54	85/01/04	85/02/14	41	*	*
7	54	85/02/14	85/03/15	29	*	*
8	54	85/03/15	85/04/23	39	0.38	.014
9	54	85/04/23	85/05/29	36	0.27	.010

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	36	1 low	y	good	changed 1 battery
2	36	1 dead	y	good	changed 1 battery
3	36	1 low	y	good	changed 1 battery
4	36	1 low	y	good	changed 1 battery
5	36	fair	n	good	wb Jan.4
6	54	low	y	good	new batteries
7	54	low	y	good	new batteries
8	54	low	y	good	new batteries
9	54	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5145400
Easting :377800

STATION: D8

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.005 (0.13)	Mean Exposure Period:	35
Max. Radon Level:	0.013 (0.34)	Max. Exposure Period:	43
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	29

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	50	84/06/13	84/07/12	29	0.34	.013
2	50	84/07/12	84/08/14	33	*	*
3	50	84/08/14	84/09/16	33	<0.1	<.004
4	50	84/09/16	84/10/29	43	0.08	.003
5	50	84/10/29	84/12/04	36	<0.05	<.002
6	47	84/12/04	85/01/04	31	0.09	.003
7	47	85/01/04	85/02/05	32	0.29	.011
8	53	85/02/05	85/03/15	38	<0.1	<.004
9	47	85/03/15	85/04/23	39	0.28	.010
10	47	85/04/23	85/05/29	36	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	50	good	n	good	
2	50	2 low	y	good	change 2 batteries
3	50	1 dead	y	good	1 battery changed
4	50	good	n	good	
5	50	good	n	good	wb Dec.4
6	47	low	y	good	2 new batteries
7	47	low	y	good	2 new batteries
8	53	low	y	good	new batteries
9	47	low	y	good	new batteries
10	47	low	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5146900
Easting :373400

STATION: D9

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.008 (0.21)	Mean Exposure Period:	35
Max. Radon Level:	0.009 (0.23)	Max. Exposure Period:	49
Min. Radon Level:	0.007 (0.19)	Min. Exposure Period:	27

Number of SNS* Readings: 8

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON	
					pCi/L	Bq/L
1	53	84/06/13	84/07/12	29	0.23	.009
2	53	84/07/12	84/08/14	33	*	*
3	53	84/08/14	84/10/02	49	*	*
4	53	84/10/02	84/10/29	27	*	*
5	53	84/10/29	84/11/29	31	*	*
6	53	84/11/29	85/01/09	41	*	*
7	53	85/01/09	85/02/05	27	0.19	.007
8	53	85/02/05	85/03/15	38	*	*
9	53	85/03/15	85/04/23	39	*	*
10	53	85/04/23	85/05/29	36	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	53	good	n	good	
2	53	both low	y	good	changed 2 batteries
3	53	2 low	y	good	changed 2 batteries
4	53	good	n	good	
5	53	good	n	good	wb Nov.29
6	53	dead	y	good	2 new batteries
7	53	low	y	good	new batteries
8	53	low	y	good	new batteries
9	53	dead	y	nil	new batteries
10	53	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5148800
Easting :373900

STATION: D10

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.003 (0.09)	Mean Exposure Period:	35
Max. Radon Level:	0.011 (0.31)	Max. Exposure Period:	48
Min. Radon Level:	0.0004 (0.01)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	38	84/06/13	84/07/12	29	<0.1	<.004
2	38	84/07/12	84/08/16	35	<0.1	<.004
3	38	84/08/16	84/09/18	33	0.01	<.001
4	38	84/09/18	84/11/05	48	0.1	.004
5	38	84/11/05	84/12/12	37	0.06	.002
6	38	84/12/12	85/01/10	29	0.05	.002
7	29	85/01/10	85/02/05	26	*	*
8	29	85/02/05	85/03/15	38	0.14	.005
9	29	85/03/15	85/04/23	39	0.31	.011
10	29	85/04/23	85/05/29	36	0.17	.006

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	38	good	n	good	
2	38	1 d 1 low	y	good	changed 2 batteries
3	38	good	n	good	
4	38	good	n	good	
5	38	good	n	good	wb Dec.12
6	38	fair	n	low	new inst. #29
7	29	low	y	good	new batteries
8	29	dead	y	nil	new batteries
9	29	very low	y	low	new batteries
10	29	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5148900
Easting :375000

STATION: D11

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.008 (0.23)	Mean Exposure Period:	35
Max. Radon Level:	0.034 (0.92)	Max. Exposure Period:	48
Min. Radon Level:	0.003 (0.07)	Min. Exposure Period:	26

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	35	84/06/13	84/07/12	29	0.26	.010
2	35	84/07/12	84/08/16	35	<0.1	<.004
3	35	84/08/16	84/09/18	33	0.13	.005
4	35	84/09/18	84/11/05	48	0.21	.008
5	35	84/11/05	84/12/12	37	0.07	.003
6	5	84/12/12	85/01/10	29	*	*
7	5	85/01/10	85/02/05	26	0.92	.034
8	5	85/02/05	85/03/15	38	0.24	.009
9	5	85/03/15	85/04/23	39	*	*
10	5	85/04/23	85/05/29	36	0.7	.026

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	35	both low	y	good	changed 2 batteries
2	35	good	n	good	
3	35	good	n	good	moved down hill 20 metres
4	35	2 low	y	good	changed 2 batteries
5	35	good	n	good	wb Dec.12
6	5	dead	y	good	2 new batteries
7	5	low	y	good	new batteries
8	5	low	y	good	new batteries
9	5	low	y	low	new batteries
10	5	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5148200
Easting :375100

STATION: D12

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.006 (0.17)	Mean Exposure Period:	35
Max. Radon Level:	0.011 (0.29)	Max. Exposure Period:	47
Min. Radon Level:	0.002 (0.06)	Min. Exposure Period:	26

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	83	84/06/13	84/07/12	29	0.29	.011
2	83	84/07/12	84/08/16	35	<0.18	<.007
3	83	84/08/16	84/10/02	47	*	*
4	83	84/10/02	84/11/05	34	0.22	.008
5	83	84/11/05	84/12/12	37	0.06	.002
6	11	84/12/12	85/01/10	29	0.08	.003
7	11	85/01/10	85/02/05	26	0.25	.009
8	11	85/02/05	85/03/15	38	*	*
9	11	85/03/15	85/04/23	39	*	*
10	11	85/04/23	85/05/29	36	0.28	.010

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	83	good	n	good	
2	83	good	n	good	
3	83	good	n	good	
4	83	good	n	good	
5	83	good	n	good	wb Dec.12
6	11	fair	n	low	new inst. #11
7	11	low	y	good	new batteries
8	11	low	y	low	new batteries
9	11	very low	y	low	new batteries
10	11	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: DENISON

LOCATION: Northing:5149200
Easting :376000

STATION: D13

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.008	(0.22)	Mean Exposure Period:	35
Max. Radon Level:	0.015	(0.4)	Max. Exposure Period:	48
Min. Radon Level:	0.004	(0.1)	Min. Exposure Period:	26

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	46	84/06/13	84/07/12	29	<0.1	<.004
2	46	84/07/12	84/08/16	35	*	*
3	46	84/08/16	84/09/18	33	0.4	.015
4	46	84/09/18	84/11/05	48	0.25	.009
5	46	84/11/05	84/12/12	37	*	*
6	46	84/12/12	85/01/10	29	0.15	.006
7	46	85/01/10	85/02/05	26	0.17	.006
8	18	85/02/05	85/03/15	38	*	*
9	18	85/03/15	85/04/23	39	*	*
10	18	85/04/23	85/05/29	36	0.39	.014

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	46	both low	y	good	changed 2 batteries
2	46	1 d 1 low	y	good	changed 2 batteries
3	46	good	n	good	
4	46	good	n	good	
5	46	good	n	good	wb Dec.12
6	46	fair	y	good	changed 2 batteries
7	46	low	y	low	new batteries
8	18	low	y	low	new batteries
9	18	low	y	low	new batteries
10	18	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137200
Easting :378900

STATION: N1

SUMMARY STATISTICS

	Bq/L (pCi/L)			Days
Mean Radon Level:	0.015	(0.48)	Mean Exposure Period:	36.3
Max. Radon Level:	0.040	(1.09)	Max. Exposure Period:	55
Min. Radon Level:	0.004	(0.11)	Min. Exposure Period:	24

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	90	84/06/15	84/07/09	24	0.90	.033
2	90	84/07/09	84/08/13	35	0.65	.024
3	90	84/08/13	84/09/17	35	0.73	.027
4	90	84/09/17	84/11/02	46	0.39	.014
5	90	84/11/02	84/12/27	55	*	*
6	90	84/12/27	85/01/25	29	0.26	.010
7	90	85/01/25	85/02/25	31	0.11	.004
8	90	85/02/25	85/03/22	25	1.09	.040
9	90	85/03/22	85/05/10	49	0.25	.009
10	90	85/05/10	85/06/13	34	0.20	.007

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	90	1 dead	y	good	changed 1 dead battery
2	90	1 low	y	good	changed 1 battery
3	90	good	n	good	
4	90	1 low	y	good	changed 1 battery
5	90	dead	y	good	new pack , wb Nov. 20
6	90	good	y	no charge	new battery pack
7	90	low	y	good	new batteries
8	90	low	y	nil	new batteries
9	90	fair	y	good	new batteries
10	90	fair			

* Statistically Not Significant.

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5138000
Easting :379700

STATION: N2

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.011 (0.30)	Mean Exposure Period:	36.7
Max. Radon Level:	0.016 (0.42)	Max. Exposure Period:	55
Min. Radon Level:	0.006 (0.16)	Min. Exposure Period:	25

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	55	84/06/11	84/07/09	28	0.36	.013
2	55	84/07/09	84/08/13	35	0.37	.014
3	55	84/08/13	84/09/17	35	0.35	.013
4	55	84/09/17	84/11/02	46	0.33	.012
5	55	84/11/02	84/12/27	55	0.19	.007
6	50	84/12/27	85/01/25	29	*	*
7	50	85/01/25	85/02/25	31	0.42	.016
8	50	85/02/25	85/03/22	25	0.39	.014
9	50	85/03/22	85/05/10	49	0.25	.009
10	82	85/05/10	85/06/13	34	0.16	.006

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	55	good	n	good	
2	55	2 low	y	good	changed two batteries
3	55	good	n	good	
4	55	1 low	y	good	changed 1 battery
5	55	dead	y	good	new pack , wb Nov. 20
6	50	low	y	no charge	new pack
7	50	low	y	low	new batteries
8	50	low	y	good	new batteries
9	50	low	n	nil	not holding charge,new inst.#82
10	82	fair			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5138300
Easting :379000

STATION: N3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.016 (0.44)	Mean Exposure Period:	36.7
Max. Radon Level:	0.146 (3.94)	Max. Exposure Period:	55
Min. Radon Level:	0.002 (0.06)	Min. Exposure Period:	25

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	82	84/06/11	84/07/09	28	1.22	.045
2	82	84/07/09	84/08/13	35	1.14	.042
3	82	84/08/13	84/09/19	37	*	*
4	82	84/09/19	84/11/02	44	3.94	.146
5	51	84/11/02	84/12/27	55	0.16	.006
6	51	84/12/27	85/01/25	29	*	*
7	49	85/01/25	85/02/25	31	*	*
8	49	85/02/25	85/03/22	25	*	*
9	49	85/03/22	85/05/10	49	0.13	.005
10	49	85/05/10	85/06/13	34	0.06	.002

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	82	good	n	good	
2	82	2 low	y	good	changed 2 batteries
3	82	1 low	y	good	1 battery changed
4	82	good	n	good	
5	51	good	n	good	wb Dec.27
6	51				
7	49	low	y	good	new batteries
8	49	low	y	nil	new batteries
9	49	fair	y	good	new batteries
10	49				

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5138300
Easting :378100

STATION: N4

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.018 (0.50)	Mean Exposure Period:	36.7
Max. Radon Level:	0.076 (2.05)	Max. Exposure Period:	57
Min. Radon Level:	0.004 (0.10)	Min. Exposure Period:	25

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	84	84/06/11	84/07/09	28	2.05	.076
2	84	84/07/09	84/08/13	35	1.88	.070
3	84	84/08/13	84/09/17	35	<0.1	<.004
4	84	84/09/17	84/11/13	57	0.75	.028
5	84	84/11/13	84/12/27	44	0.5	.019
6	84	84/12/27	85/01/25	29	*	*
7	20	85/01/25	85/02/25	31	0.47	.017
8	20	85/02/25	85/03/22	25	0.49	.018
9	20	85/03/22	85/05/10	49	0.36	.013
10	20	85/05/10	85/06/13	34	0.16	.006

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	84	good	n	good	
2	84	good	n	good	
3	84	1 dead	y	good	1 new battery
4	84	good	n	good	
5	84	good	n	good	wb Dec. 27
6	84				
7	20	low	y	good	new batteries
8	20	low	y	good	new batteries
9	20	very low	y	low	new batteries
10	20	low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137500
Easting :377800

STATION: N5

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.014 (0.39)	Mean Exposure Period:	36.7
Max. Radon Level:	0.049 (1.31)	Max. Exposure Period:	55
Min. Radon Level:	0.004 (0.12)	Min. Exposure Period:	25

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	86	84/06/11	84/07/09	28	1.31	.049
2	86	84/07/09	84/08/13	35	0.93	.034
3	86	84/08/13	84/09/17	35	0.24	.009
4	86	84/09/17	84/11/02	46	0.26	.010
5	86	84/11/02	84/12/27	55	0.12	.004
6	86	84/12/27	85/01/25	29	*	*
7	86	85/01/25	85/02/25	31	*	*
8	30	85/02/25	85/03/22	25	0.37	.014
9	30	85/03/22	85/05/10	49	0.36	.013
10	30	85/05/10	85/06/13	34	0.45	.017

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	86	good	n	good	
2	86	good	n	good	
3	86	2 low	y	good	2 new batteries
4	86	good	n	good	
5	86	dead	y	good	1 bat new, wb Nov.27
6	86				
7	86	low	n	low	change inst. to #30
8	30	low	y	good	new batteries
9	30	low	y	good	new batteries
10	30	fair			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137400
Easting :378000

STATION: N6

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.011	(0.29)	Mean Exposure Period:	36.7
Max. Radon Level:	0.051	(1.37)	Max. Exposure Period:	55
Min. Radon Level:	0.003	(0.07)	Min. Exposure Period:	25

Number of SNS* Readings: 0

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	85	84/06/11	84/07/09	28	1.37	.051
2	85	84/07/09	84/08/13	35	0.75	.028
3	85	84/08/13	84/09/17	35	0.47	.017
4	85	84/09/17	84/11/02	46	0.59	.022
5	85	84/11/02	84/12/27	55	0.12	.004
6	85	84/12/27	85/01/25	29	0.08	.003
7	85	85/01/25	85/02/25	31	0.2	.007
8	85	85/02/25	85/03/22	25	0.07	.003
9	85	85/03/22	85/05/10	49	0.19	.007
10	85	85/05/10	85/06/13	34	0.53	.020

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	85	good	n	good	
2	85	good	n	good	
3	85	2 low	y	good	2 new batteries
4	85	good	n	good	
5	85	low	y	good	new pack , wb Nov.20
6	85	low	y	low	new pack
7	85	low	y	low	new batteries
8	85	low	y	good	new batteries
9	85	low	y	low	new batteries
10	85	low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137400
Easting :378600

STATION: N7

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.028 (0.76)	Mean Exposure Period:	36.4
Max. Radon Level:	0.103 (2.77)	Max. Exposure Period:	55
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	25

Number of SNS* Readings: 0

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	49	84/06/14	84/07/09	25	1.87	.069
2	49	84/07/09	84/08/13	35	2.77	.103
3	49	84/08/13	84/09/17	35	1.61	.060
4	49	84/09/17	84/11/02	46	0.93	.034
5	49	84/11/02	84/12/27	55	0.05	.002
6	33	84/12/27	85/01/25	29	0.92	.034
7	33	85/01/25	85/02/25	31	1.92	.071
8	37	85/02/25	85/03/22	25	0.26	.010
9	37	85/03/22	85/05/10	49	0.73	.027
10	37	85/05/10	85/06/13	34	0.52	.019

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	49	good	n	good	
2	49	1 low	y	good	changed 1 battery
3	49	1 low	y	good	1 new battery
4	49	good	n	good	
5	49	good	n	good	wb Dec.27
6	33				
7	33	low	n	none	change to inst #37
8	37	low	n	good	
9	37	very low	y	nil	new batteries
10	37	fair			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137900
Easting :378350

STATION: NT1

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.070 (1.84)	Mean Exposure Period:	33.8
Max. Radon Level:	0.255 (6.89)	Max. Exposure Period:	46
Min. Radon Level:	0.023 (0.63)	Min. Exposure Period:	25

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	3	84/06/14	84/07/09	25	*	*
2	37	84/07/19	84/08/13	25	0.7	.026
3	37	84/08/13	84/09/17	35	6.89	.255
4	37	84/09/17	84/11/02	46	4.73	.175
5	37	84/11/02	84/12/11	39	1.32	.049
6	37	84/12/11	85/01/14	34	*	*
7	37	85/01/14	85/02/15	32	1.27	.047
8	19	85/02/15	85/03/19	32	1.61	.060
9	19	85/03/19	85/04/17	29	3.45	.128
10	19	85/04/17	85/05/28	41	0.63	.023

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	3	good	n	low	switched with NT4 07/19
2	37	both dead	y	good	changed 2 batteries
3	37	good	n	good	
4	37	good	n	good	
5	37	good	n	good	wb Nov.20
6	37	dead	y	good	new pack
7	37	low	n	good	new inst.#19
8	19	low	y	good	new batteries
9	19	low	y	good	new batteries
10	19	low	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137900
Easting :378350

STATION: NT2

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.030	(0.94)	Mean Exposure Period:	34.8
Max. Radon Level:	0.147	(3.98)	Max. Exposure Period:	46
Min. Radon Level:	0.006	(0.15)	Min. Exposure Period:	25

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	52	84/06/14	84/07/09	25	*	*
2	52	84/07/09	84/08/13	35	3.49	.129
3	52	84/08/13	84/09/17	35	3.89	.144
4	52	84/09/17	84/11/02	46	3.98	.147
5	52	84/11/02	84/12/11	39	0.48	.018
6	52	84/12/11	85/01/14	34	*	*
7	52	85/01/14	85/02/15	32	*	*
8	52	85/02/15	85/03/19	32	0.15	.006
9	52	85/03/19	85/04/17	29	0.27	.010
10	52	85/04/17	85/05/28	41	0.62	.023

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	52	good	n	good	
2	52	1 low	y	good	1 battery changed
3	52	1 dead	y	good	1 battery changed
4	52	good	n	good	
5	52	good	n	good	wb Nov.20
6	52	dead	y	good	new pack
7	52	low	y	low	new batteries
8	52	low	y	good	new batteries
9	52	fair	y	good	new pack
10	52	fair	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137900
Easting :378350

STATION: NT3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.034 (0.91)	Mean Exposure Period:	34.8
Max. Radon Level:	0.086 (2.33)	Max. Exposure Period:	46
Min. Radon Level:	0.014 (0.37)	Min. Exposure Period:	25

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	88	84/06/14	84/07/09	25	1.47	.054
2	88	84/07/09	84/08/13	35	2.33	.086
3	88	84/08/13	84/09/17	35	1.95	.072
4	88	84/09/17	84/11/02	46	1.19	.044
5	4	84/11/02	84/12/11	39	0.68	.025
6	4	84/12/11	85/01/16	36	*	*
7	4	85/01/16	85/02/15	30	*	*
8	4	85/02/15	85/03/19	32	0.37	.014
9	4	85/03/19	85/04/17	29	0.42	.016
10	4	85/04/17	85/05/28	41	0.55	.020

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	88	good	n	good	
2	88	good	n	good	
3	88	good	n	good	
4	88	good	n	nil	
5	4	good	n	good	wb Nov.20
6	4	low	y	good	new pack
7	4	low	y	low	new batteries
8	4	low	y	low	new batteries
9	4	fair	y	low	new pack
10	4	low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: NORDIC

LOCATION: Northing:5137900
Easting :378350

STATION: NT4

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.014	(0.37)	Mean Exposure Period:	34.8
Max. Radon Level:	0.026	(0.71)	Max. Exposure Period:	46
Min. Radon Level:	0.007	(0.18)	Min. Exposure Period:	25

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	37	84/06/14	84/07/19	35	0.35	.013
2	3	84/07/19	84/08/13	25	*	*
3	3	84/08/13	84/09/17	35	0.46	.017
4	3	84/09/17	84/11/02	46	0.45	.017
5	3	84/11/02	84/12/11	39	0.31	.011
6	3	84/12/11	85/01/16	36	*	*
7	3	85/01/16	85/02/15	30	0.71	.026
8	3	85/02/15	85/03/19	32	0.18	.007
9	3	85/03/19	85/04/17	29	0.41	.015
10	3	85/04/17	85/05/28	41	0.27	.010

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	37	good	n	good	switched with NT1 07/19
2	3	good	n	good	
3	3	good	n	good	new board inst. Aug.14 HV=1330
4	3	good	n	good	
5	3	good	n	good	wb Nov.20
6	3	low	y	good	new pack
7	3	low	y	good	new batteries
8	3	low	y	low	new batteries
9	3	good	n	good	
10	3	low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151800
Easting :377400

STATION: Q1

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.006 (0.16)	Mean Exposure Period:	34.8
Max. Radon Level:	0.026 (0.71)	Max. Exposure Period:	40
Min. Radon Level:	0.001 (0.04)	Min. Exposure Period:	26

Number of SNS* Readings: 0

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	1	84/06/14	84/07/10	26	0.3	.011
2	1	84/07/10	84/08/13	34	0.71	.026
3	1	84/08/13	84/09/19	37	0.17	.006
4	1	84/09/19	84/10/29	40	0.14	.005
5	1	84/10/29	84/11/29	31	0.09	.003
6	88	84/11/29	85/01/03	35	0.09	.003
7	88	85/01/03	85/02/04	32	0.41	.015
8	88	85/02/04	85/03/12	36	<0.1	<.004
9	88	85/03/12	85/04/18	37	0.04	.001
10	88	85/04/18	85/05/28	40	0.13	.005

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	1	good	n	good	
2	1	good	n	good	
3	1	good	n	good	
4	1	2 low	y	good	2 batteries changed
5	1				wb Nov.29
6	88	pack dead	y	good	new pack
7	88	low	y	good	new batteries
8	88	low	y	low	new batteries
9	88	very low	y	low	new batteries
10	88	very low	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151800
Easting :374100

STATION: Q2

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.021 (0.57)	Mean Exposure Period:	34.8
Max. Radon Level:	0.049 (1.31)	Max. Exposure Period:	40
Min. Radon Level:	0.008 (0.22)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	40	84/06/14	84/07/10	26	0.9	.033
2	40	84/07/10	84/08/13	34	1.23	.046
3	40	84/08/13	84/09/19	37	1.31	.049
4	40	84/09/19	84/10/29	40	0.87	.032
5	40	84/10/29	84/11/29	31	0.36	.013
6	40	84/11/29	85/01/03	35	0.22	.008
7	40	85/01/03	85/02/04	32	0.24	.009
8	40	85/02/04	85/03/12	36	0.59	.022
9	40	85/03/12	85/04/18	37	0.48	.018
10	40	85/04/18	85/05/28	40	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	40	good	n	good	
2	40	2 low	y	good	changed 2 batteries
3	40	good	n	good	
4	40	2 low	y	good	2 batteries changed
5	40	good	n	good	wb Nov.29
6	40	pack dead	y	good	new pack
7	40	low	y	good	new batteries
8	40	low	y	low	new batteries
9	40	low	y	good	new batteries
10	40	very low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151600
Easting :373300

STATION: Q3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.034 (0.92)	Mean Exposure Period:	38.7
Max. Radon Level:	0.095 (2.56)	Max. Exposure Period:	66
Min. Radon Level:	0.010 (0.28)	Min. Exposure Period:	26

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	5	84/06/14	84/07/10	26	1.12	.041
2	5	84/07/10	84/08/13	34	1.96	.073
3	5	84/08/13	84/09/19	37	1.09	.040
4	5	84/09/19	84/10/29	40	*	*
5	43	84/10/29	85/01/03	66	0.28	.010
6	51	85/01/03	85/02/04	32	2.56	.095
7	51	85/02/04	85/03/12	36	1.04	.039
8	51	85/03/12	85/04/18	37	0.31	.011
9	51	85/04/18	85/05/28	40	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	5	good	n	good	
2	5	good	n	good	
3	5	2 low	y	good	2 batteries changed
4	5	good	n	nil	new inst. #43
5	43	2 dead	n	good	wb Jan.3
6	51	low	y	good	counts not columnated & new batteries
7	51	dead	y	none	new batteries
8	51	low	y	good	new batteries
9	51	very low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:3151800
Easting :372500

STATION: Q4

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.008 (0.22)	Mean Exposure Period:	38.3
Max. Radon Level:	0.026 (0.71)	Max. Exposure Period:	62
Min. Radon Level:	0.001 (0.04)	Min. Exposure Period:	26

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	7	84/06/15	84/07/11	26	*	*
2	7	84/07/11	84/08/15	35	*	*
3	4	84/08/17	84/09/19	33	*	*
4	4	84/09/19	84/11/02	44	0.36	.013
5	9	84/11/02	85/01/03	62	0.04	.001
6	84	85/01/03	85/02/04	32	0.71	.026
7	84	85/02/04	85/03/13	37	0.1	.004
8	84	85/03/13	85/04/19	37	*	*
9	33	85/04/19	85/05/28	39	0.47	.017

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	7	1 low	y	low	changed 1 battery
2	7	1 low	y	good	1 battery changed
3	4	1low,1d	n	nil	changed monitor, new board HV=1100
4	4	1 low		nil	new inst. #9
5	9	1 dead		good	
6	84	low	y	low	new batteries
7	84	low	y	good	new batteries
8	84	fair	y	none	new inst. #33, new batteries
9	33	low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5152200
Easting :371400

STATION: Q5

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.004 (0.12)	Mean Exposure Period:	34.7
Max. Radon Level:	0.009 (0.25)	Max. Exposure Period:	40
Min. Radon Level:	0.002 (0.06)	Min. Exposure Period:	25

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	28	84/06/15	84/07/10	25	0.25	.009
2	28	84/07/10	84/08/13	34	<0.1	<.004
3	28	84/08/13	84/09/19	37	*	*
4	28	84/09/19	84/10/29	40	0.06	.002
5	28	84/10/29	84/11/29	31	*	*
6	28	84/11/29	85/01/03	35	*	*
7	28	85/01/03	85/02/04	32	0.06	.002
8	28	85/02/04	85/03/12	36	0.21	.008
9	28	85/03/12	85/04/18	37	0.15	.006
10	28	85/04/18	85/05/28	40	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	28	good	y	good	
2	28	both low	y	good	changed 2 batteries
3	28	1 low	y	low	1 battery changed
4	28	good	n	good	
5	28	good	n	good	wb Nov.29
6	28	pack dead	y	good	new pack
7	28	low	y	good	new batteries
8	28	low	y	good	new batteries
9	28	very low	y	good	new batteries
10	28	very low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151700
Easting :370300

STATION: Q6

SUMMARY STATISTICS

	Bq/L (pCi/L)
Mean Radon Level:	0.007 (0.20)
Max. Radon Level:	0.014 (0.37)
Min. Radon Level:	0.004 (0.11)

	Days
Mean Exposure Period:	38.6
Max. Exposure Period:	62
Min. Exposure Period:	26

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	15	84/06/15	84/07/11	26	0.34	.013
2	15	84/07/11	84/08/15	35	0.12	.004
3	15	84/08/15	84/09/19	35	0.15	.006
4	15	84/09/19	84/11/02	44	0.28	.010
5	15	84/11/02	85/01/03	62	0.11	.004
6	15	85/01/03	85/02/04	32	0.37	.014
7	15	85/02/04	85/03/13	37	*	*
8	86	85/03/13	85/04/23	41	*	*
9	86	85/04/23	85/05/28	35	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	15	1 low	y	good	changed 1 battery
2	15	1 low	y	good	changed 1 battery
3	15	good	n	good	
4	15	1 low	y	good	changed 1 battery
5	15	pack dead	y	good	new pack, wb Nov.26
6	15	low	y	good	new batteries
7	15	low	y	good	new batteries
8	86	low	y	good	new batteries
9	86	low		good	broke wire during removal

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA:QUIRKE

LOCATION: Northing:5151400
Easting :369500

STATION: Q7

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.007	(0.18)	Mean Exposure Period:	38.6
Max. Radon Level:	0.012	(0.33)	Max. Exposure Period:	55
Min. Radon Level:	0.004	(0.1)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	6	84/06/15	84/07/11	26	0.25	.009
2	6	84/07/11	84/08/15	35	<0.1	<.004
3	6	84/08/15	84/09/19	35	0.12	.004
4	6	84/09/19	84/11/13	55	0.15	.006
5	6	84/11/13	85/01/03	51	0.1	.004
6	6	85/01/03	85/02/04	32	0.32	.012
7	6	85/02/04	85/03/13	37	0.33	.012
8	6	85/03/13	85/04/23	41	*	*
9	6	85/04/23	85/05/28	35	0.28	.010

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	6	good	n	good	
2	6	2 low	y	good	changed 2 batteries
3	6	good	n	good	
4	6	good	n	good	new position
5	6	pack dead	y	good	wb Nov.26, new pack
6	6	low	y	good	new batteries
7	6	low	y	good	new batteries
8	6	low	y	low	new batteries
9	6	very low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5150800
Easting :371100

STATION: Q8

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.009 (0.24)	Mean Exposure Period:	38.6
Max. Radon Level:	0.025 (0.68)	Max. Exposure Period:	62
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	26

Number of SNS* Readings: 0

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	14	84/06/15	84/07/11	26	0.32	.012
2	14	84/07/11	84/08/15	35	0.17	.006
3	14	84/08/15	84/10/02	48	0.21	.008
4	14	84/10/02	84/11/02	31	<0.05	<.002
5	5	84/11/02	85/01/03	62	0.07	.003
6	5	85/01/03	85/02/04	32	0.68	.025
7	5	85/02/04	85/03/13	37	0.48	.018
8	5	85/03/13	85/04/23	41	0.47	.017
9	5	85/04/23	85/05/28	35	0.49	.018

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	14	1 low	y	good	changed 1 battery
2	14	1 dead	y	good	1 battery changed
3	14	good	n	good	
4	14	good	n	none	
5	5	pack dead	n	good	wb Nov.26
6	5	low	y	good	new batteries
7	5	low	y	good	new batteries
8	5	low	y	good	new batteries
9	5	low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5150500
Easting :372100

STATION: Q9

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.007 (0.20)	Mean Exposure Period:	38.6
Max. Radon Level:	0.016 (0.42)	Max. Exposure Period:	62
Min. Radon Level:	0.004 (0.1)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	24	84/06/15	84/07/11	26	0.19	.007
2	24	84/07/11	84/08/15	35	0.42	.016
3	24	84/08/15	84/09/19	35	0.26	.010
4	24	84/09/19	84/11/02	44	0.15	.006
5	24	84/11/02	85/01/03	62	*	*
6	24	85/01/03	85/02/04	32	0.32	.012
7	24	85/02/04	85/03/13	37	<0.1	<.004
8	24	85/03/13	85/04/19	37	0.14	.005
9	24	85/04/19	85/05/28	39	0.2	.007

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	24	2 low	y	good	changed 2 batteries
2	24	good	y	good	changed 2 batteries
3	24	good	n	good	
4	24	2 low	y	good	changed 2 batteries
5	24	pack dead	y	good	wb Nov.26, new pack
6	24	low	y	good	new batteries
7	24	low	y	good	new batteries
8	24	low	y	good	new batteries
9	24	very low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5149900
Easting :372300

STATION: Q10

SUMMARY STATISTICS

	Bq/L	(pCi/L)
Mean Radon Level:	0.005	(0.14)
Max. Radon Level:	0.009	(0.25)
Min. Radon Level:	0.002	(0.06)

	Days
Mean Exposure Period:	34.8
Max. Exposure Period:	43
Min. Exposure Period:	26

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	22	84/06/14	84/07/10	26	0.1	.004
2	22	84/07/10	84/08/14	35	0.19	.007
3	22	84/08/14	84/09/16	33	0.14	.005
4	22	84/09/16	84/10/29	43	0.06	.002
5	22	84/10/29	84/11/29	31	*	*
6	1	84/11/29	85/01/03	35	*	*
7	1	85/01/03	85/02/04	32	0.25	.009
8	89	85/02/04	85/03/13	37	0.21	.008
9	89	85/03/13	85/04/19	37	*	*
10	89	85/04/19	85/05/28	39	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	22	good	n	good	
2	22	1 low	y	good	changed 1 battery
3	22	1 low	y	good	changed 1 battery
4	22	good	n	good	
5	22	good	n	good	wb Nov. 29, new inst. #1
6	1	pack dead	y	good	new pack
7	1	low	n	good	broken wire,change to inst.#89
8	89	low	y	good	new batteries
9	89	low	y	good	new batteries
10	89	very low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5150700
Easting :373400

STATION: Q11

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.008 (0.22)	Mean Exposure Period:	34.8
Max. Radon Level:	0.014 (0.37)	Max. Exposure Period:	40
Min. Radon Level:	0.003 (0.08)	Min. Exposure Period:	26

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	47	84/06/14	84/07/10	26	0.5	.019
2	47	84/07/10	84/08/13	34	*	*
3	47	84/08/13	84/09/19	37	*	*
4	47	84/09/19	84/10/29	40	0.16	.006
5	47	84/10/29	84/11/29	31	*	*
6	87	84/11/29	85/01/03	35	0.08	.003
7	87	85/01/03	85/02/04	32	*	*
8	87	85/02/04	85/03/13	37	0.27	.010
9	87	85/03/13	85/04/19	37	0.37	.014
10	46	85/04/19	85/05/28	39	0.18	.007

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	47	good	n	good	
2	47	good	n	good	
3	47	good	n	good	
4	47	1 low	n	good	
5	47	good	n	good	new inst. #87, wb Nov.29
6	87	pack dead	y	good	new pack
7	87	low	y	good	new batteries
8	87	low	y	low	new batteries
9	87	low	n	good	new inst. #16 head loose on one side
10	46	low		good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151300
Easting :371800

STATION: QT1

SUMMARY STATISTICS

	Bq/L (pCi/L)			Days
Mean Radon Level:	0.030 (0.73)		Mean Exposure Period:	36.2
Max. Radon Level:	0.098 (2.64)		Max. Exposure Period:	48
Min. Radon Level:	0.005 (0.14)		Min. Exposure Period:	23

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	26	84/06/15	84/07/11	26	1.12	.041
2	26	84/07/11	84/08/15	35	0.93	.034
3	26	84/08/15	84/10/02	48	1.03	.038
4	26	84/10/02	84/11/05	34	0.96	.036
5	26	84/11/05	84/12/11	36	0.29	.011
6	26	84/12/11	85/01/09	29	*	*
7	26	85/01/09	85/02/26	48	2.64	.098
8	26	85/02/26	85/03/21	23	*	*
9	26	85/03/21	85/05/03	43	0.14	.005
10	26	85/05/03	85/06/12	40	0.76	.028

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	26	good	n	good	
2	26	2 low	y	good	2 batteries changed
3	26	good	n	good	
4	26	good	n	good	
5	26	good	n	good	wb Nov.26
6	26	dead	y	good	2 new batteries
7	26	low	y	low	new batteries
8	26	dead	y	nil	new batteries
9	26	very low	y	good	new batteries
10	26	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151300
Easting :371800

STATION: QT2

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.030 (0.88)	Mean Exposure Period:	36.1
Max. Radon Level:	0.059 (1.60)	Max. Exposure Period:	48
Min. Radon Level:	0.021 (0.56)	Min. Exposure Period:	23

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	12	84/06/15	84/07/11	26	1.6	.059
2	12	84/07/11	84/08/15	35	1.37	.051
3	12	84/08/15	84/09/19	35	0.37	.014
4	12	84/09/19	84/11/05	46	0.96	.036
5	12	84/11/05	84/12/11	36	0.64	.024
6	12	84/12/11	85/01/09	29	*	*
7	12	85/01/09	85/02/26	48	1.32	.049
8	12	85/02/26	85/03/21	23	*	*
9	12	85/03/21	85/05/03	43	0.56	.021
10	12	85/05/03	85/06/12	40	0.98	.036

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	12	good	n	good	
2	12	2 low	y	good	2 batteries changed
3	12	1 low	y	good	changed 2 batteries
4	12	good	n	good	
5	12	good	n	good	wb Nov.26
6	12	low	y	good	2 new batteries
7	12	low	y	good	new batteries
8	12	low	y	good	new batteries
9	12	very low	y	good	new batteries
10	12	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151300
Easting :371800

STATION: QT3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.024 (0.65)	Mean Exposure Period:	36.1
Max. Radon Level:	0.051 (1.39)	Max. Exposure Period:	48
Min. Radon Level:	0.005 (0.13)	Min. Exposure Period:	23

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	16	84/06/15	84/07/11	26	0.9	.033
2	16	84/07/11	84/08/15	35	0.48	.018
3	16	84/08/15	84/09/19	35	0.13	.005
4	16	84/09/19	84/11/05	46	1.07	.040
5	16	84/11/05	84/12/11	36	0.94	.035
6	16	84/12/11	85/01/09	29	*	*
7	16	85/01/09	85/02/26	48	1.39	.051
8	16	85/02/26	85/03/21	23	0.24	.009
9	16	85/03/21	85/05/03	43	1.0	.037
10	16	85/05/03	85/06/12	40	1.03	.038

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	16	good	n	good	
2	16	2 low	y	good	2 batteries changed
3	16	good	n	good	
4	16	good	n	good	
5	16	good	n	good	wb Nov.26
6	16	dead	y	good	new pack
7	16	low	y	low	new batteries
8	16	low	y	low	new batteries
9	16	low	y	good	new batteries
10	16	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: QUIRKE

LOCATION: Northing:5151300
Easting :371800

STATION: QT4

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.008 (0.22)	Mean Exposure Period:	36.1
Max. Radon Level:	0.027 (0.74)	Max. Exposure Period:	48
Min. Radon Level:	0.003 (0.09)	Min. Exposure Period:	23

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	10	84/06/15	84/07/11	26	<0.1	<.004
2	10	84/07/11	84/08/15	35	*	.000
3	10	84/08/15	84/09/19	35	0.15	.006
4	10	84/09/19	84/11/05	46	0.09	.003
5	10	84/11/05	84/12/11	36	0.56	.021
6	10	84/12/11	85/01/09	29	*	.000
7	10	85/01/09	85/02/26	48	0.74	.027
8	33	85/02/26	85/03/21	23	*	.000
9	43	85/03/21	85/05/03	43	0.32	.012
10	43	85/05/03	85/06/12	40	0.16	.006

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	10	1 low	y	good	changed 1 battery
2	10	1 dead	y	good	changed 1 battery
3	10	2 low	n	good	
4	10	1 d 1 low	n	good	
5	10	good	n	good	wb Nov.26
6	10	dead	y	good	new pack
7	10	low	n	none	Inst. changed to #33
8	33	low	n	low	Inst. changed to #43
9	43	low	n	low	new batteries
10	43	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5145000
Easting :380700

STATION: S1

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.006 (0.15)	Mean Exposure Period:	36.4
Max. Radon Level:	0.022 (0.60)	Max. Exposure Period:	45
Min. Radon Level:	0.003 (0.08)	Min. Exposure Period:	29

Number of SNS* Readings: 5

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	41	84/06/13	84/07/12	29	0.6	.022
2	41	84/07/12	84/08/14	33	<0.1	<.004
3	41	84/08/14	84/09/16	33	*	*
4	41	84/09/16	84/10/29	43	*	*
5	41	84/10/29	84/12/04	36	*	*
6	22	84/12/04	85/01/04	31	*	*
7	22	85/01/04	85/02/05	32	0.15	.006
8	22	85/02/05	85/03/15	38	0.12	.004
9	22	85/03/15	85/04/29	45	*	*
10	22	85/04/29	85/06/12	44	0.08	.003

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	41	good	n	good	
2	41	1 low 1 d	y	good	changed 2 batteries
3	41	1 low	n	good	
4	41	good	n	good	
5	41	good	n	good	wb Dec.4
6	22	dead	y	good	new batteries
7	22	low	y	good	new batteries
8	22	low	y	good	new batteries
9	22	very low	y	good	new batteries
10	22	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5145300
Easting :382200

STATION: S2

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.004 (0.12)	Mean Exposure Period:	36.4
Max. Radon Level:	0.015 (0.41)	Max. Exposure Period:	45
Min. Radon Level:	0.001 (0.04)	Min. Exposure Period:	29

Number of SNS* Readings: 6

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	9	84/06/13	84/07/12	29	0.11	.004
2	9	84/07/12	84/08/14	33	<0.1	<.004
3	9	84/08/14	84/09/18	33	*	*
4	9	84/09/18	84/10/29	43	*	*
5	8	84/10/29	84/12/04	36	*	*
6	41	84/12/04	85/01/04	31	*	*
7	41	85/01/04	85/02/04	31	0.41	.015
8	41	85/02/04	85/03/15	39	*	*
9	41	85/03/15	85/04/29	45	*	*
10	41	85/04/29	85/06/12	44	0.04	.001

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	9	good	n	good	
2	9	good	n	no charge	
3	9	good	y	good	batteries changed
4	9	good	n	low	
5	8	good	n	good	wb Dec.4
6	41	dead	y	good	2 new 9v batteries
7	41	low	y	good	new batteries
8	41	dead	y	nil	new batteries
9	41	very low	y	good	new batteries
10	41	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5145400
Easting :383000

STATION: S3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.005 (0.13)	Mean Exposure Period:	40.4
Max. Radon Level:	0.013 (0.35)	Max. Exposure Period:	66
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	29

Number of SNS* Readings: 4

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	81	84/06/13	84/07/12	29	0.2	.007
2	81	84/07/12	84/08/14	33	0.11	.004
3	81	84/08/14	84/09/18	35	0.11	.004
4	81	84/09/18	84/10/30	42	*	*
5	81	84/10/30	85/01/04	66	<0.05	<.002
6	43	85/01/04	85/02/04	31	0.35	.013
7	43	85/02/04	85/03/15	39	*	*
8	15	85/03/15	85/04/29	45	*	*
9	15	85/04/29	85/06/12	44	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	81	good	n	good	
2	81	good	n	good	
3	81	2 low	n	good	
4	81	good	n	good	
5	81	good	n	good	wb Jan.4
6	43	low	y	good	new batteries
7	43	low	y	low	new batteries,new inst. #15
8	15	low	y	good	new batteries
9	15	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5146300
Easting :382500

STATION: S4

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.014 (0.37)	Mean Exposure Period:	36.4
Max. Radon Level:	0.048 (1.30)	Max. Exposure Period:	45
Min. Radon Level:	0.004 (0.10)	Min. Exposure Period:	29

Number of SNS* Readings: 0

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	19	84/06/13	84/07/12	29	0.52	.019
2	19	84/07/12	84/08/14	33	0.32	.012
3	19	84/08/14	84/09/16	33	0.41	.015
4	19	84/09/16	84/10/29	43	0.41	.015
5	19	84/10/29	84/12/04	36	0.14	.005
6	8	84/12/04	85/01/04	31	0.1	.004
7	8	85/01/04	85/02/05	32	0.21	.008
8	8	85/02/05	85/03/15	38	0.57	.021
9	8	85/03/15	85/04/29	45	1.3	.048
10	8	85/04/29	85/06/12	44	0.77	.029

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	19	good	n	good	
2	19	1 low	y	good	changed 1 battery
3	19	1 low	n	good	
4	19	1 low	n	good	
5	19	good	n	good	wb Dec.4
6	8	good	n	good	
7	8	low	y	low	new batteries
8	8	low	y	good	new batteries
9	8	low	y	good	new batteries
10	8	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5146900
Easting :382100

STATION: S5

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.008 (0.21)	Mean Exposure Period:	36.4
Max. Radon Level:	0.033 (0.88)	Max. Exposure Period:	45
Min. Radon Level:	0.003 (0.08)	Min. Exposure Period:	29

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON	
					pCi/L	Bq/L
1	23	84/06/13	84/07/12	29	0.34	.013
2	23	84/07/12	84/08/14	33	0.88	.033
3	23	84/08/14	84/09/16	33	0.39	.014
4	23	84/09/16	84/10/29	43	*	*
5	23	84/10/19	84/12/04	36	0.17	.006
6	31	84/12/04	85/01/04	31	*	*
7	31	85/01/04	85/02/14	41	<0.1	<.004
8	31	85/02/14	85/03/15	29	0.11	.004
9	31	85/03/15	85/04/29	45	0.24	.009
10	31	85/04/29	85/06/12	44	0.08	.003

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	23	both low	y	good	changed 2 batteries
2	23	good	n	good	
3	23	good	n	good	
4	23	good	n	good	contaminated
5	23				wb Dec.4
6	31	low	n	good	
7	31	low	n	low	
8	31	low	y	good	new batteries
9	31	low	y	good	new batteries
10	31	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5147400
Easting :381300

STATION: S6

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.006 (0.16)	Mean Exposure Period:	36.4
Max. Radon Level:	0.014 (0.37)	Max. Exposure Period:	45
Min. Radon Level:	0.003 (0.07)	Min. Exposure Period:	29

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON	
					pCi/L	Bq/L
1	21	84/06/13	84/07/12	29	0.17	.006
2	21	84/07/12	84/08/14	33	0.13	.005
3	21	84/08/14	84/09/16	33	0.21	.008
4	21	84/09/16	84/10/29	43	0.11	.004
5	21	84/10/29	84/12/04	36	0.07	.003
6	19	84/12/04	85/01/04	31	*	*
7	19	85/01/04	85/02/05	32	*	*
8	1	85/02/05	85/03/15	38	*	*
9	1	85/03/15	85/04/29	45	0.18	.007
10	1	85/04/29	85/06/12	44	0.37	.014

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	21	both low	y	good	changed 2 batteries
2	21	good	n	good	
3	21	2 low	y	good	2 batteries changed
4	21	good	n	good	
5	21	good	n	good	
6	19	pack low	n	good	wb Dec.4
7	19	low	n	low	inst change to #1
8	1	low	n	low	
9	1	very low	y	low	1 new battery 9 v.
10	1	very low			wire broken

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5147800
Easting :381400

STATION: S7

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.005 (0.13)	Mean Exposure Period:	36.4
Max. Radon Level:	0.009 (0.25)	Max. Exposure Period:	45
Min. Radon Level:	0.001 (0.03)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	31	84/06/13	84/07/12	29	0.23	.009
2	31	84/07/12	84/08/14	33	0.2	.007
3	31	84/08/14	85/09/16	33	<0.1	<.004
4	31	84/09/16	84/10/30	44	0.18	.007
5	31	84/10/30	84/12/04	35	0.07	.003
6	50	84/12/04	85/01/10	37	*	*
7	36	85/01/10	85/02/05	26	0.24	.009
8	36	85/02/05	85/03/15	38	<0.1	<.004
9	36	85/03/15	85/04/29	45	0.25	.009
10	36	85/04/29	85/06/12	44	0.03	.001

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	31	1 low	y	good	changed 1 battery
2	31	1 low	y	good	changed 1 battery
3	31	1 low	y	good	changed 1 battery
4	31	1 low	y	good	changed 1 battery
5	31	good	n	good	wb Dec.4
6	50	low	n	good	inst. change
7	36	low	y	good	new batteries
8	36	low	y	low	new batteries
9	36	very low	y	low	new batteries
10	36	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5146900
Easting :380800

STATION: S8

SUMMARY STATISTICS

	Bq/L (pCi/L)			Days
Mean Radon Level:	0.005	(0.14)	Mean Exposure Period:	40.4
Max. Radon Level:	0.012	(0.33)	Max. Exposure Period:	72
Min. Radon Level:	0.001	(0.03)	Min. Exposure Period:	26

Number of SNS* Readings: 0

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	34	84/06/13	85/07/12	29	0.23	.009
2	34	84/07/12	84/08/16	35	0.27	.010
3	34	84/08/16	84/09/18	33	0.24	.009
4	34	84/09/18	84/10/30	42	0.33	.012
5	34	84/10/30	85/01/10	72	0.1	.004
6	27	85/01/10	85/02/05	26	0.18	.007
7	27	85/02/05	85/03/15	38	<0.1	<.004
8	27	85/03/15	85/04/29	45	0.03	.001
9	27	85/04/29	85/06/12	44	0.08	.003

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	34	good	n	good	
2	34	2 low	y	good	changed 2 batteries
3	34	good	n	good	
4	34	good	n	good	
5	34	good	n	good	wb Jan.10
6	27	low	y	good	new batteries
7	27	low	y	nil	new batteries
8	27	low	y	good	new batteries
9	27	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5147000
Easting :380200

STATION: S9

SUMMARY STATISTICS

	Bq/L (pCi/L)			Days
Mean Radon Level:	0.006	(0.16)	Mean Exposure Period:	40.4
Max. Radon Level:	0.040	(1.07)	Max. Exposure Period:	72
Min. Radon Level:	0.001	(0.02)	Min. Exposure Period:	29

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	13	84/06/13	84/07/12	29	0.2	.007
2	13	84/07/12	84/08/16	35	<0.1	<.004
3	13	84/08/16	84/09/18	33	*	*
4	13	84/09/18	84/10/30	42	<0.1	<.004
5	13	84/10/30	85/01/10	72	*	*
6	38	85/01/10	85/02/14	35	0.25	.009
7	38	85/02/14	85/03/15	29	1.07	.040
8	38	85/03/15	85/04/29	45	0.32	.012
9	38	85/04/29	85/06/12	44	0.02	.001

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	13	good	n	low	charge low
2	13	2 low	y	good	changed 2 batteries
3	13	2 low	y	good	changed 2 batteries
4	13	good	n	good	contaminated
5	13	1 low	y	good	2 9v. wb Jan.10
6	38	good	n	none	
7	38	low	y	good	new batteries
8	38	low	y	good	detector 90 deg. in unit, new batteries
9	38	dead			broken wire

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: STANROCK

LOCATION: Northing:5146400
Easting :381300

STATION: S10

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.009 (0.23)	Mean Exposure Period:	40.4
Max. Radon Level:	0.023 (0.63)	Max. Exposure Period:	48
Min. Radon Level:	0.001 (0.03)	Min. Exposure Period:	26

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	27	84/06/13	84/07/12	29	0.63	.023
2	27	84/07/12	84/08/16	35	0.44	.016
3	27	84/08/16	84/09/18	33	0.39	.014
4	27	84/09/18	84/11/05	48	0.28	.010
5	27	84/11/05	85/01/10	46	0.03	.001
6	50	85/01/10	85/02/05	26	<0.1	<.004
7	50	85/02/05	85/03/15	38	*	*
8	50	85/03/15	85/04/29	45	0.32	.012
9	50	85/04/29	85/06/12	44	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	27	1 low	y	good	changed 1 battery
2	27	1 dead	y	fair	1 battery changed
3	27	good	n	good	
4	27	1 low	y	good	1 battery changed
5	27	1 fair	n	good	wb Jan. 10
6	50	low	y	good	new batteries
7	50	dead	y	nil	new batteries
8	50	low	y	low	new batteries
9	50	very low			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: ELLIOT LAKE

LOCATION: Northing:5136900
Easting :375300

STATION: EL1

SUMMARY STATISTICS

	Bq/L	(pCi/L)
Mean Radon Level:	0.007	(0.20)
Max. Radon Level:	0.009	(0.25)
Min. Radon Level:	0.005	(0.14)

	Days
Mean Exposure Period:	35
Max. Exposure Period:	44
Min. Exposure Period:	26

Number of SNS* Readings: 5

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	Bq/L
1	89	84/06/15	84/07/11	26	0.14	.005
2	89	84/07/11	84/08/15	35	0.18	.007
3	89	84/08/15	84/09/19	35	*	*
4	89	84/09/19	84/10/31	42	0.22	.008
5	89	84/10/31	84/12/12	42	0.22	.008
6	83	84/12/12	85/01/16	35	0.25	.009
7	13	85/01/16	85/02/20	35	*	*
8	13	85/02/20	85/03/20	28	*	*
9	13	85/03/20	85/05/03	44	*	*
10	13	85/05/03	85/05/31	28	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	89	1 low	y	good	1 battery changed
2	89	good	n	good	
3	89	good	n	good	
4	89	1 low	n	good	
5	89	good	n	good	wb Dec.12
6	83	low	n	good	
7	13	low	y	low	new batteries
8	13	low	y	good	new batteries
9	13	low	n	good	
10	13	low	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: ELLIOT LAKE

LOCATION: Northing:5138000
Easting :373000

STATION: EL2

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.006 (0.157)	Mean Exposure Period:	38.8
Max. Radon Level:	0.019 (0.50)	Max. Exposure Period:	69
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	26

Number of SNS* Readings: 1

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	29	84/06/15	84/07/11	26	<0.1	<.004
2	29	84/07/11	84/08/15	35	<0.5	<.019
3	29	84/08/15	84/09/19	35	<0.1	<.004
4	29	84/09/19	84/10/31	42	0.14	.005
5	29	84/10/31	85/01/08	69	0.05	.002
6	42	85/01/08	85/02/20	43	0.2	.007
7	42	85/02/20	85/03/20	28	0.13	.005
8	42	85/03/20	85/05/03	44	0.4	.015
9	42	85/05/03	85/05/31	28	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	29	1 low	y	good	1 new battery
2	29	1 dead	y	good	1 new battery
3	29	good	n	good	
4	29	1 low	y	good	changed 1 battery
5	29		n	good	wb Jan.8
6	42	low	y	good	new batteries
7	42	low	y	good	new batteries
8	42	low	y	good	new batteries
9	42	low	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: ELLIOT LAKE

LOCATION: Northing:5136400
Easting :372800

STATION: EL3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.004 (0.10)	Mean Exposure Period:	37.5
Max. Radon Level:	0.007 (0.20)	Max. Exposure Period:	46
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	28

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
5	82	84/10/19	84/12/04	46	*	*
6	21	84/12/04	85/01/09	37	<0.05	<.002
7	21	85/01/09	85/02/20	42	0.1	.004
8	21	85/02/20	85/03/20	28	*	*
9	21	85/03/20	85/05/03	44	0.2	.007
10	21	85/05/03	85/05/31	28	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
5	82	good	n	good	
6	21	fair	n	good	
7	21	low	y	low	new batteries
8	21	low	y	low	new batteries
9	21	low	y	good	new batteries
10	21	very low	n	good	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: BACKGROUND

LOCATION: Mississaugi
Provincial
Park

STATION: BKGD1

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.006	(0.17)	Mean Exposure Period:	34.8
Max. Radon Level:	0.018	(0.48)	Max. Exposure Period:	40
Min. Radon Level:	0.002	(0.06)	Min. Exposure Period:	26

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	87	84/06/14	84/07/10	26	0.4	.015
2	87	84/07/10	84/08/13	34	0.12	.004
3	87	84/08/13	84/09/19	37	<0.1	<.004
4	87	84/09/19	84/10/29	40	0.25	.009
5	87	84/10/29	84/11/29	31	0.06	.002
6	14	84/11/29	85/01/04	36	*	*
7	14	85/01/04	85/02/04	31	0.48	.018
8	14	85/02/04	85/03/12	36	<0.1	<.004
9	14	85/03/12	85/04/18	37	*	*
10	14	85/04/18	85/05/28	40	*	*

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	87	good	n	good	
2	87	good	n	good	
3	87	2 low	y	good	2 batteries changed
4	87	1 low	y	good	1 battery changed
5	87	good	n	good	wb Nov.29
6	14	pack dead	y	good	2 batteries changed
7	14	low	y	good	new batteries
8	14	very low	y	low	new batteries
9	14	very low	y	low	new batteries
10	14	very low	n	low	

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: BACKGROUND

LOCATION: Blind River
Hospital Roof

STATION: BKGD2

SUMMARY STATISTICS

	Bq/L	(pCi/L)		Days
Mean Radon Level:	0.004	(0.10)	Mean Exposure Period:	34.2
Max. Radon Level:	0.017	(0.47)	Max. Exposure Period:	50
Min. Radon Level:	0.002	(0.05)	Min. Exposure Period:	22

Number of SNS* Readings: 3

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
1	33	84/06/18	84/07/11	23	0.47	.017
2	33	84/07/11	84/09/21	41	0.07	.003
3	33	84/09/21	84/11/04	44	0.06	.002
4	33	84/11/04	84/12/24	50	<0.05	<.002
5	48	84/12/24	85/01/20	27	0.06	.002
6	48	85/01/20	85/02/11	22	*	*
7	48	85/02/11	85/03/08	25	*	*
8	48	85/03/08	85/04/16	39	*	*
9	48	85/04/16	85/05/23	37	0.16	.006

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
1	33	good	n	good	
2	33	good	n	good	
3	33	good	n	good	
4	33	good	n	good	wb Dec.24
5	48	low	y	good	2 new batteries
6	48	low	y	good	new batteries
7	48	dead	y	none	new batteries
8	48	very low	y	low	new batteries
9	48	good			

* Statistically Not Significant

RADON MONITORING STATION SUMMARY

TAILINGS AREA: BACKGROUND

LOCATION: East Bull AECL
Test Facility

STATION: BKGD3

SUMMARY STATISTICS

	Bq/L (pCi/L)		Days
Mean Radon Level:	0.004 (0.11)	Mean Exposure Period:	36.4
Max. Radon Level:	0.009 (0.25)	Max. Exposure Period:	72
Min. Radon Level:	0.002 (0.05)	Min. Exposure Period:	22

Number of SNS* Readings: 2

SAMPLING RESULTS

SAMPLE PERIOD	MONITOR NUMBER	INSTALLATION DATE	REMOVAL DATE	EXPOSURE (DAYS)	RADON pCi/L	RADON Bq/L
2	20	84/06/20	n/a	n/a	0.07	.003
3	20	n/a	84/09/24	30	*	*
4	20	84/09/24	84/10/24	30	0.05	.002
5	17	84/11/09	85/01/20	72	0.08	.003
6	17	85/01/20	85/02/11	22	0.2	.007
7	17	85/02/11	85/03/08	25	0.25	.009
8	17	85/03/08	85/04/16	39	*	*
9	17	85/04/16	85/05/23	37	0.1	.004

MONITOR PERFORMANCE SUMMARY

SAMPLE PERIOD	MONITOR NUMBER	BATTERY STATUS	BATTERY CHANGE	STATIC CHARGE	COMMENTS
2	20				
3	20				
4	20	1 dead	n	good	Hwy 17 &108 location
5	17	low	y	good	new pack
6	17	low	y	good	new batteries
7	17	low	y	low	new batteries
8	17	low	y	good	1 new 9v.
9	17	very low			

* Statistically Not Significant

APPENDIX A

OUTDOOR CONCENTRATIONS OF RADON DAUGHTERS COLLECTED IN THE ELLIOT LAKE AREA BY THE ONTARIO MINISTRY OF LABOUR DURING 1979-1981

- Concentrations of Radon Daughters Collected in the Elliot Lake Area by the Ontario Ministry of Labour during 1979 - 1980

Station # 71020 - Municipal Building

Averaging Period	Concentration of Radon Daughters (Working Levels)
June 18 - July 16, 1979	0.0012
July 16 - Aug. 9, 1979	0.0004
Sept. 4 - Sept. 25, 1979	0.0011
Sept. 25 - Oct. 25, 1979	0.0016
Oct. 25 - Nov. 27, 1979	0.0009
Jan. 4 - Feb. 7, 1980	<0.0003
Feb. 7 - Mar. 25, 1980	0.0006
May 12 - June 13, 1980	0.0004
July 14 - Aug. 1, 1980	0.0006

Outdoor Concentration of Radon Daughters
at Municipal Building - Elliot Lake
Collected by the Ontario Ministry of Labour

Period	Radon Daughters (WL)
January 23 - February 24, 1981	0.0006
February 24 - March 31, 1981	0.0006
May 25 - July 1, 1981	0.0005
July 1 - July 27, 1981	0.0004
August 12 - September 18, 1981	0.0009
September 18 - October 29, 1981	0.0010
October 29 - December 4, 1981	0.0010
December 4, 1981 - January 7, 1982	0.0009

Concentrations of Radon Daughters Collected in the Elliot Lake Area by the Ontario Ministry of Labour during 1979 - 1980

Station # 71054 - Nordic Townsite

Averaging Period	Concentration of Radon Daughters (Working Levels)
June 18 - July 16, 1979	0.0030
Aug. 1 - Aug. 27, 1979	0.0025
Sept. 17 - Oct. 4, 1979	0.0025
Oct. 5 - Oct. 31, 1979	0.0019
Oct. 31 - Nov. 27, 1979	0.0015
Jan. 15 - Mar. 25, 1980	0.0008
Apr. 24 - June 13, 1980	0.0014
June 13 - July 15, 1980	0.0029
July 15 - Aug. 11, 1980	0.0059
Aug. 12 - Sept. 24, 1980	0.0017
Sept. 24 - Oct. 24, 1980	0.0019

Outdoor Concentration of Radon Daughters
at Nordic Townsite
Collected by the Ontario Ministry of Labour

Period	Radon Daughters (WL)
January 23 - February 24, 1981	0.0008
February 24 - April 3, 1981	0.0004
April 5 - May 1, 1981	0.0040
May 25 - July 1, 1981	0.0016
July 1 - July 28, 1981	0.0024
July 28 - September 4, 1981	0.0052
October 2 - October 29, 1981	0.0034
October 29 - December 4, 1981	0.0024
December 4, 1981 - January 7, 1982	0.0010

Concentrations of Radon Daughters Collected in the Elliot Lake Area by the Ontario Ministry of Labour during 1979 - 1980

Station #71023 - Quirke Townsite

Averaging Period	Concentration of Radon Daughters (Working Levels)
June 18 - July 16, 1979	0.0150
July 16 - Aug. 9, 1979	0.0150
Aug. 9 - Sept. 4, 1979	0.0110
Sept. 4 - Sept. 25, 1979	0.0070
Sept. 25 - Oct. 11, 1979	0.0070
Oct. 11, 1979 - Nov. 19, 1979	0.0010
Jan. 4 - Feb. 14, 1980	0.0006
Feb. 14 - Apr. 21, 1980	0.0015
Apr. 21 - May 12, 1980	0.0060
May 12 - June 13, 1980	0.0090
June 13 - July 1, 1980	0.0140
July 1 - Aug. 11, 1980	0.0060
Aug. 12 - Sept. 24, 1980	0.0040
Sept. 24 - Oct. 23, 1980	0.0020

Outdoor Concentration of Radon Daughters
at Quirke Townsite
Collected by the Ontario Ministry of Labour

Period	Radon Daughters (WL)
January 23 - February 24, 1981	0.0014
February 24 - April 3, 1981	0.0019
June 3 - July 3, 1981	0.0066
July 3 - July 28, 1981	0.0095
July 28 - August 24, 1981	0.0170
September 22 - October 23, 1981	0.0030
November 20 - December 31, 1981	0.0027

Concentrations of Radon Daughters Collected in the Elliot Lake Area by the Ontario Ministry of Labour during 1979 - 1980

Station # 71053 - Denison Townsite

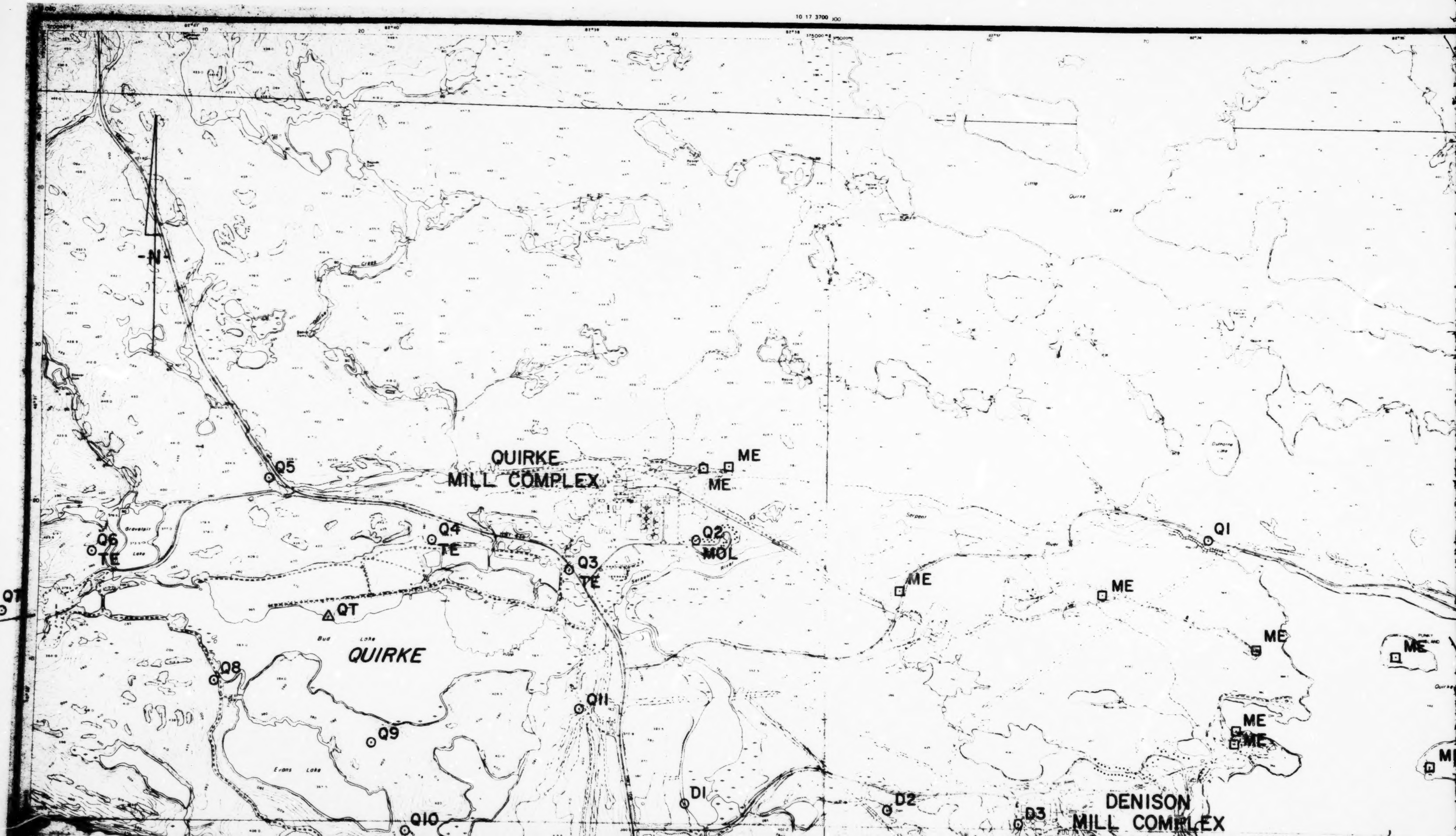
Measurement Period	Concentration of Radon Daughters (Working Levels)
June 27 - July 27, 1979	0.0017
July 27 - Aug. 20, 1979	0.0011
Aug. 20 - Sept. 1, 1979	0.0015
Oct. 15 - Nov. 19, 1979	0.0011
Jan. 4 - Feb. 14, 1980	0.0002
Feb. 14 - Apr. 21, 1980	0.0005
May 21 - June 13, 1980	0.0011
June 15 - July 1, 1980	0.0015
July 1 - Aug. 11, 1980	0.0013
Aug. 12 - Sept. 24, 1980	0.0004
Sept. 24 - Oct. 23, 1980	0.0006

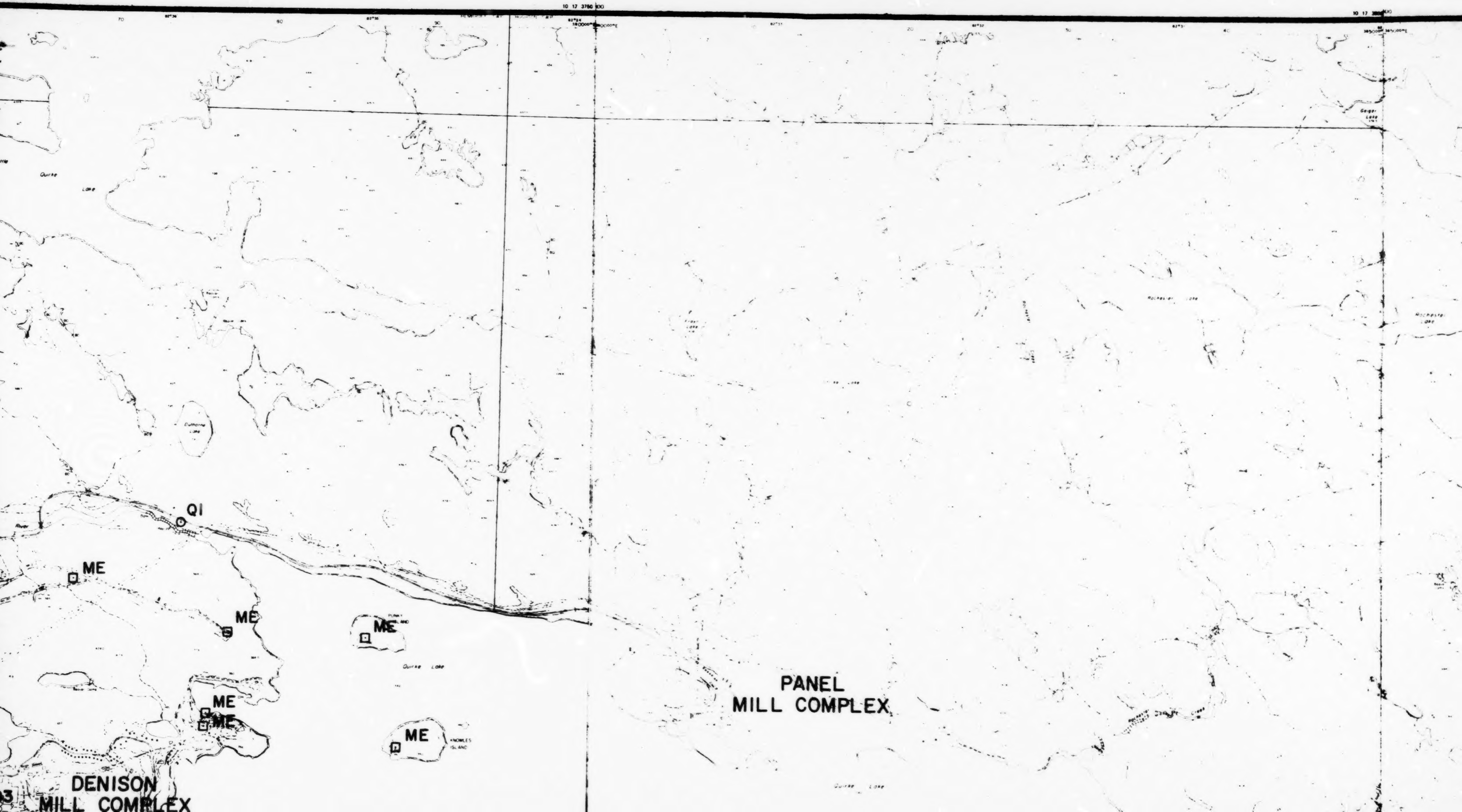
Outdoor Concentration of Radon Daughters

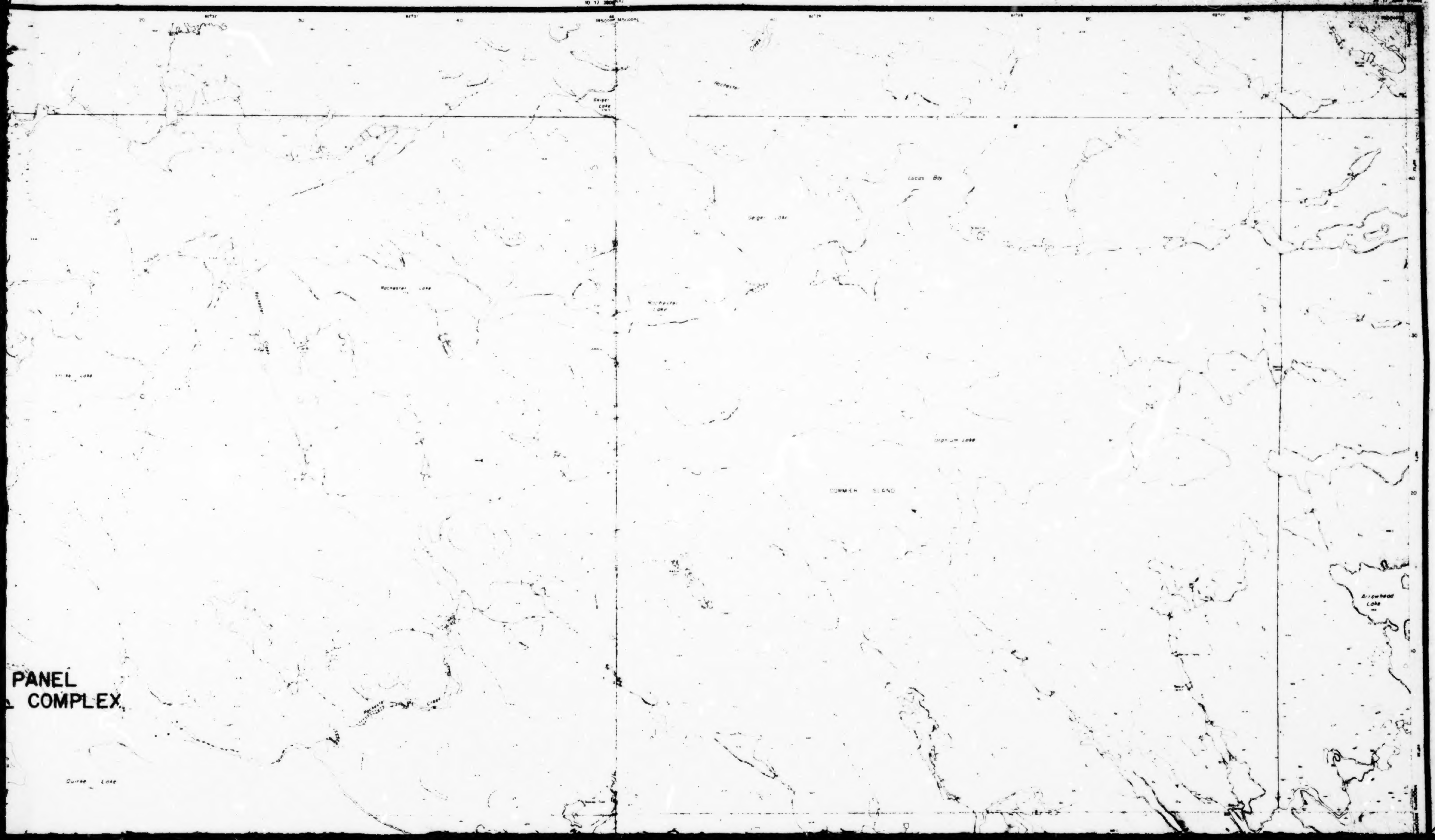
at Denison Townsite

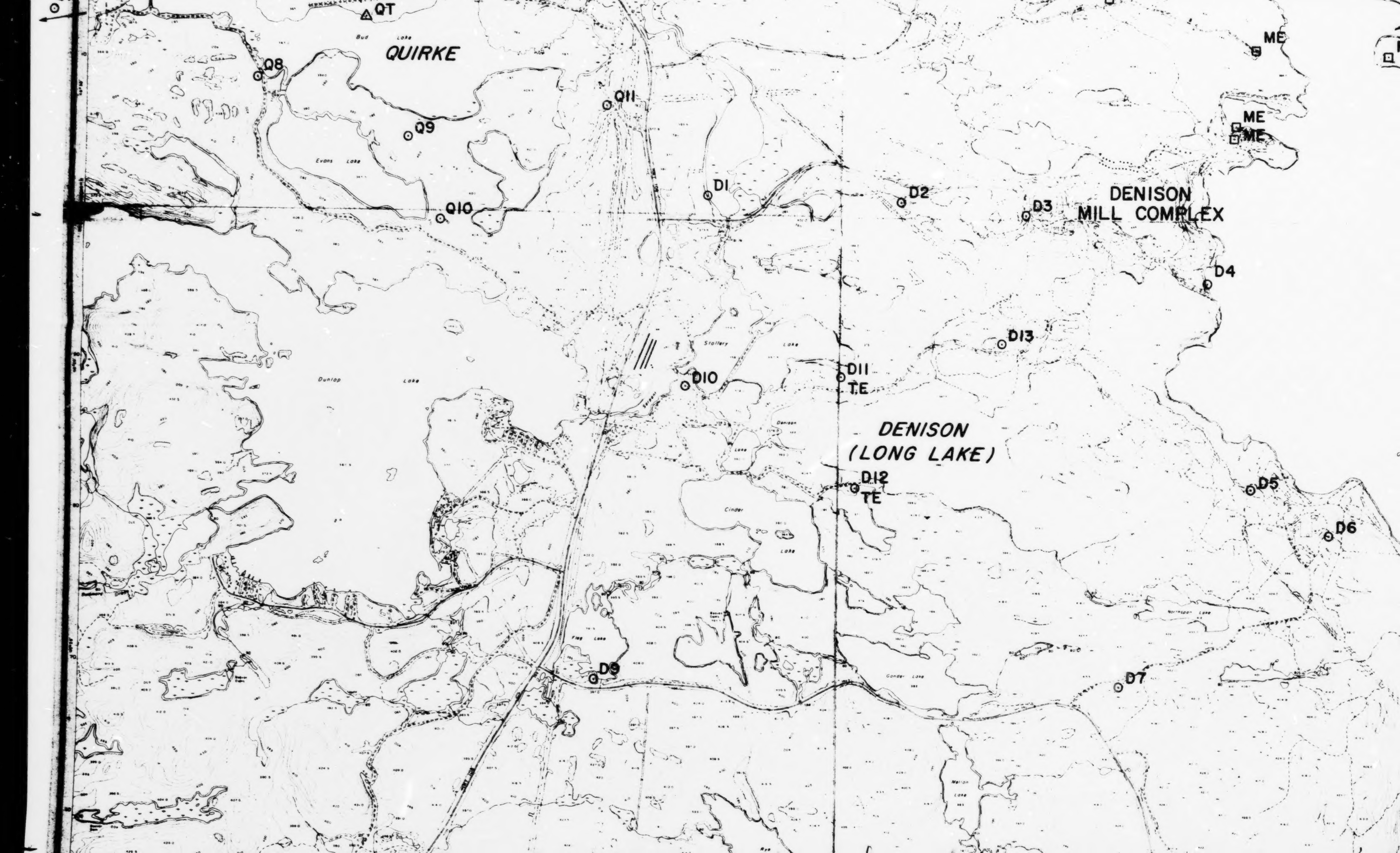
Collected by the Ontario Ministry of Labour

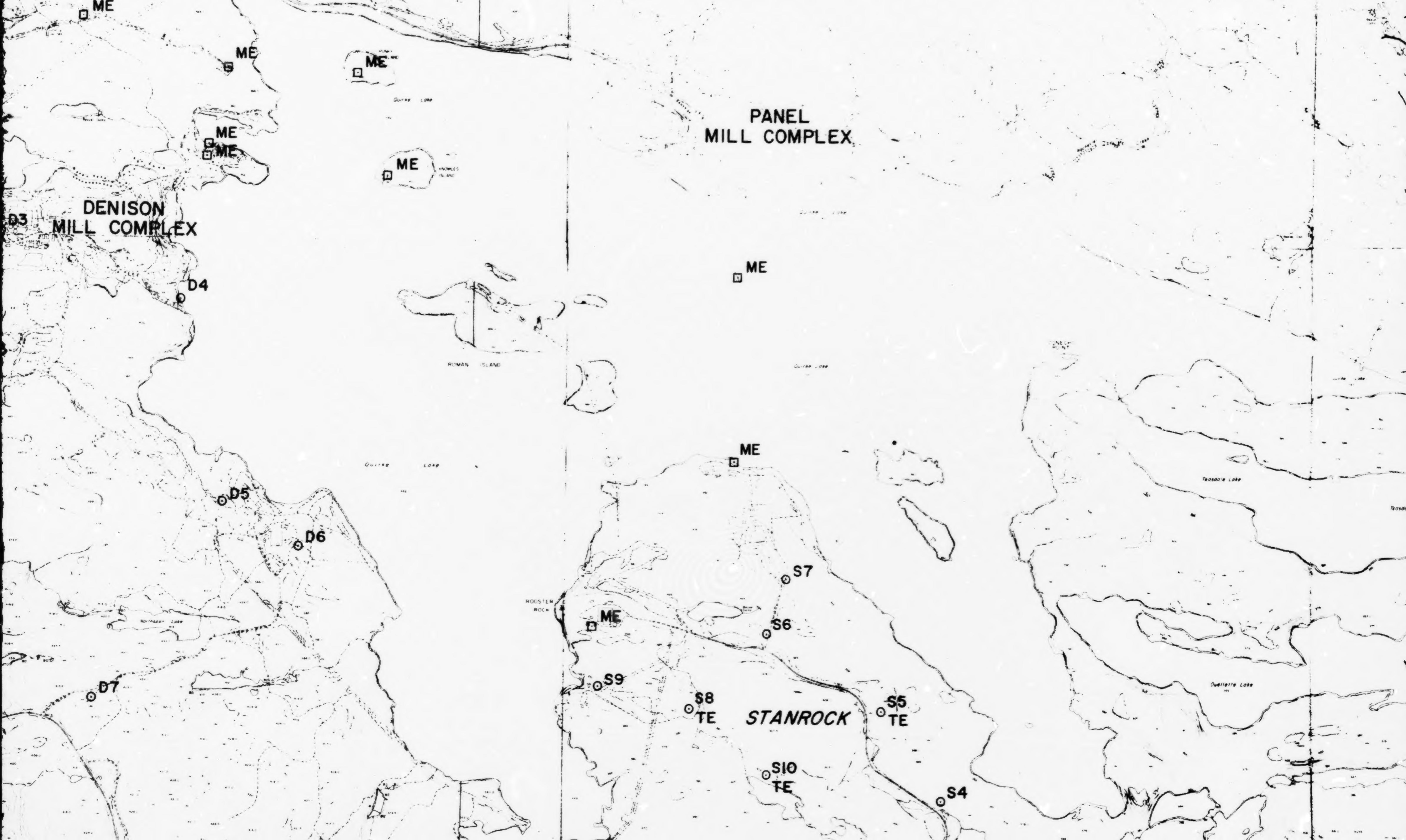
Period	Radon Daughters (WL)
March 11 - April 21, 1981	0.0008
April 21 - May 25, 1981	0.0030
June 3 - July 1, 1981	0.0009
July 16 - August 12, 1981	0.0006
August 12 - September 1, 1981	0.0014
October 2 - November 5, 1981	0.0006
November 5 - December 16, 1981	0.0007
December 16, 1981 - January 28, 1982	0.0010

10 17 3700 00
-N-
QUIRKE
MILL COMPLEX
ME
ME
Q5
Q4
TE
Q6
TE
Gravelpit Lake
Q7
Q3
TE
Q2
MOL
Serpent River
Q1
ME
ME
ME
ME
ME
ME
QT
Bud Lake
QUIRKE
Q8
Q11
Q9
Evans Lake
Q10
D1
D2
D3
DENISON
MILL COMPLEX
Little Quirke Lake

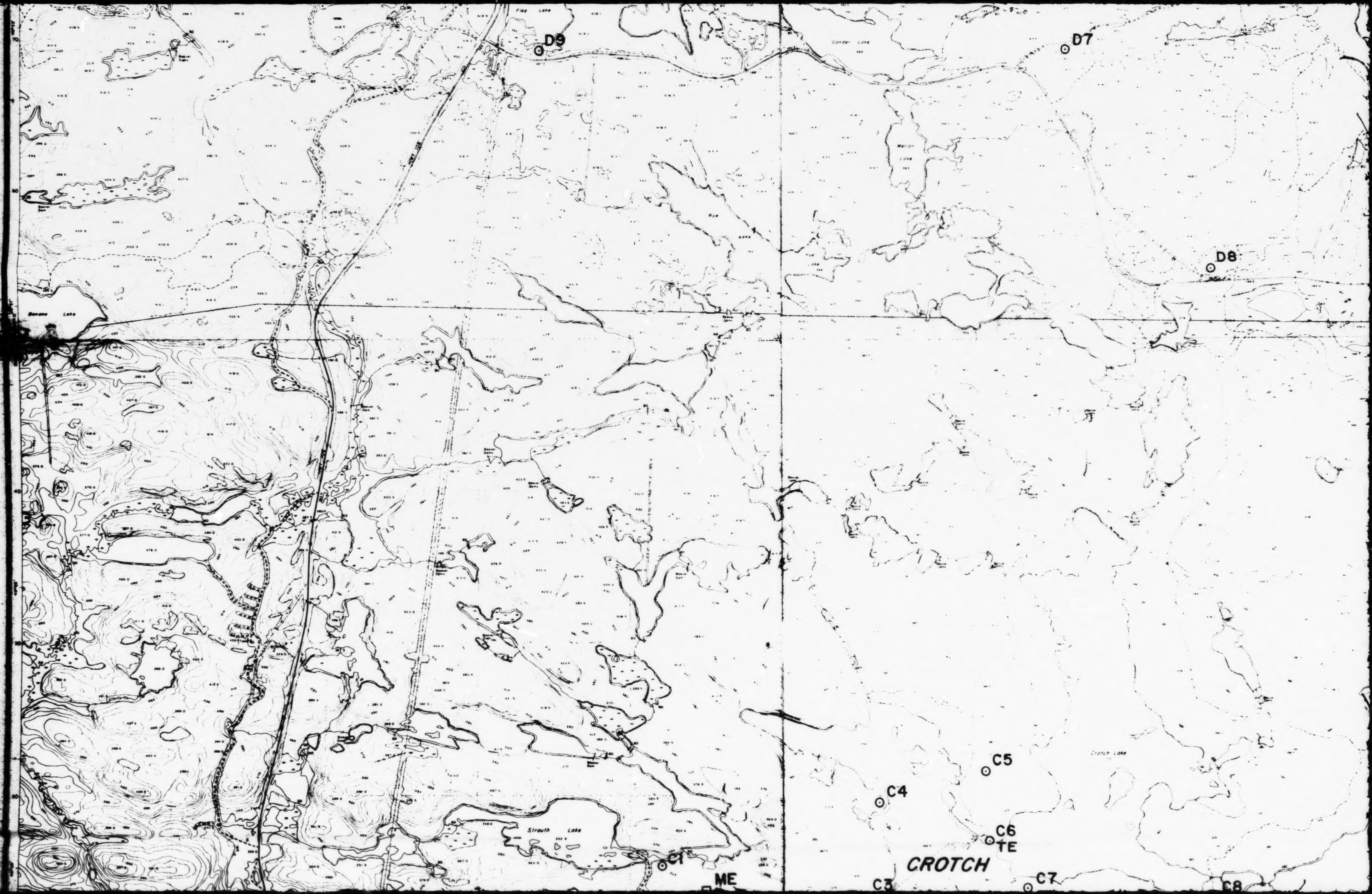

70
80
90
20
30
40
Quirke Lake
Geiger Lake
Rochester Lake
QI
ME
ME
ME
ME
ME
ME
KNOWLES ISLAND
Quirke Lake
Quirke Lake
PANEL
MILL COMPLEX
DENISON
MILL COMPLEX

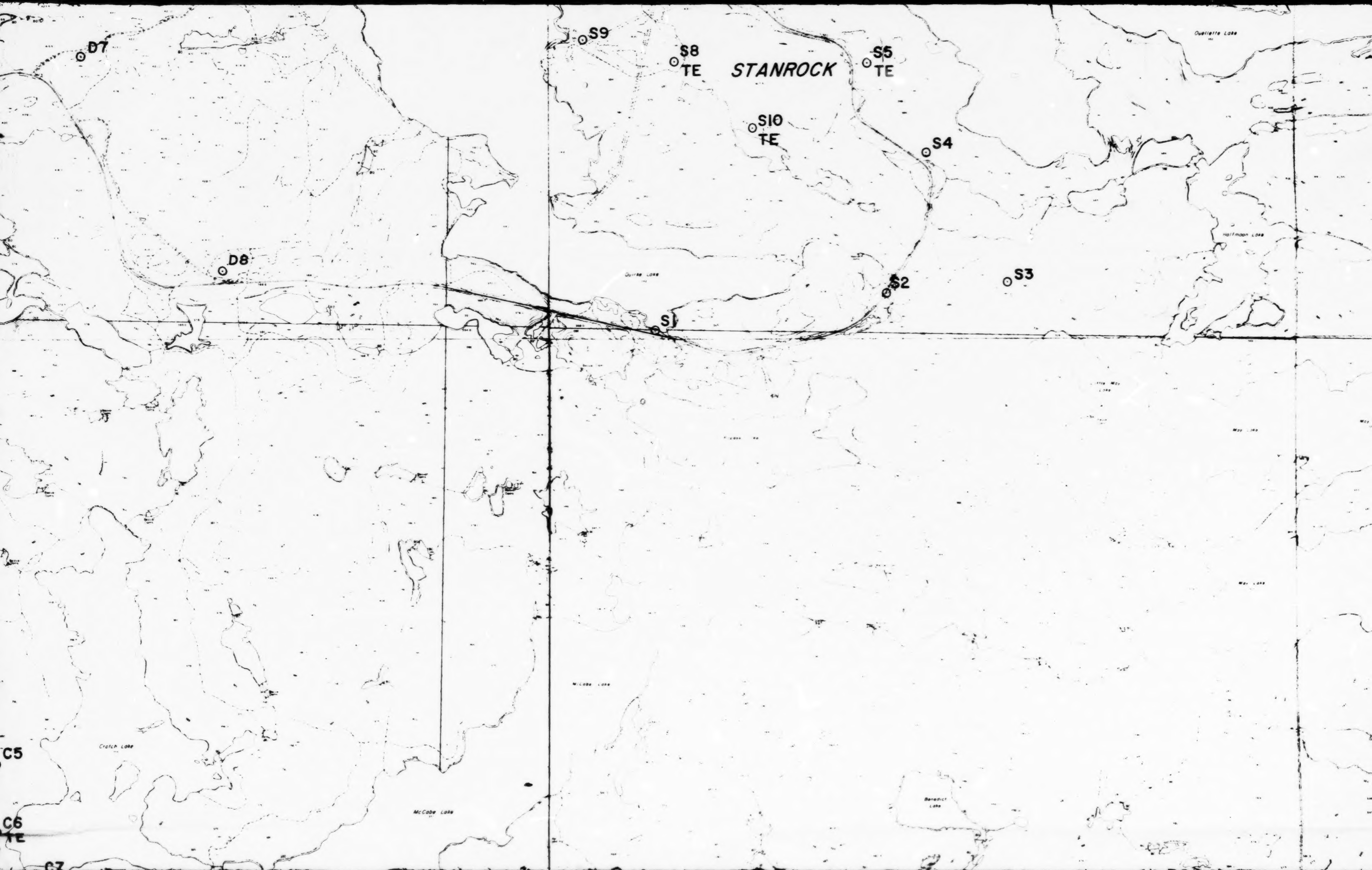

Geiger Lake
Rochester
Lucas Bay
Geiger Lake
Rochester Lake
Rochester Lake
Strike Lake
Uranium Lake
CORMIER ISLAND
Arrowhead Lake
Rochester Creek
Quirke Lake
PANEL
COMPLEX

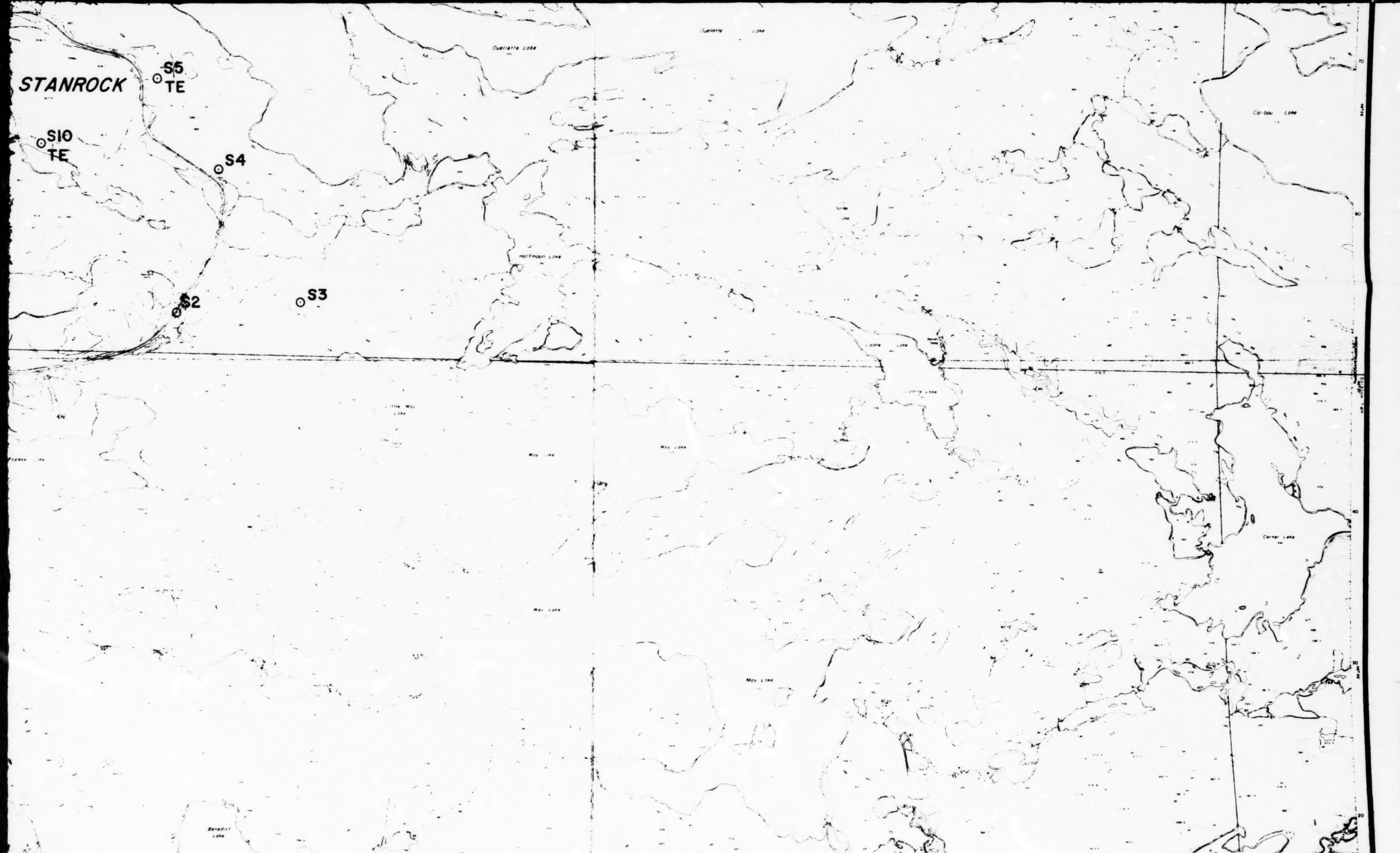

QT
Bud Lake
QUIRKE
Q8
Q11
Q9
Evans Lake
Q10
D1
D2
D3
DENISON
MILL COMPLEX
ME
ME
ME
D4
D13
Stollery Lake
Dunlop Lake
D10
D11
TE
Denison Lake
DENISON
(LONG LAKE)
D12
TE
Cinder Lake
D5
D6
Northspan Lake
Flag Lake
D9
Gander Lake
D7
Mellon Lake
Rye

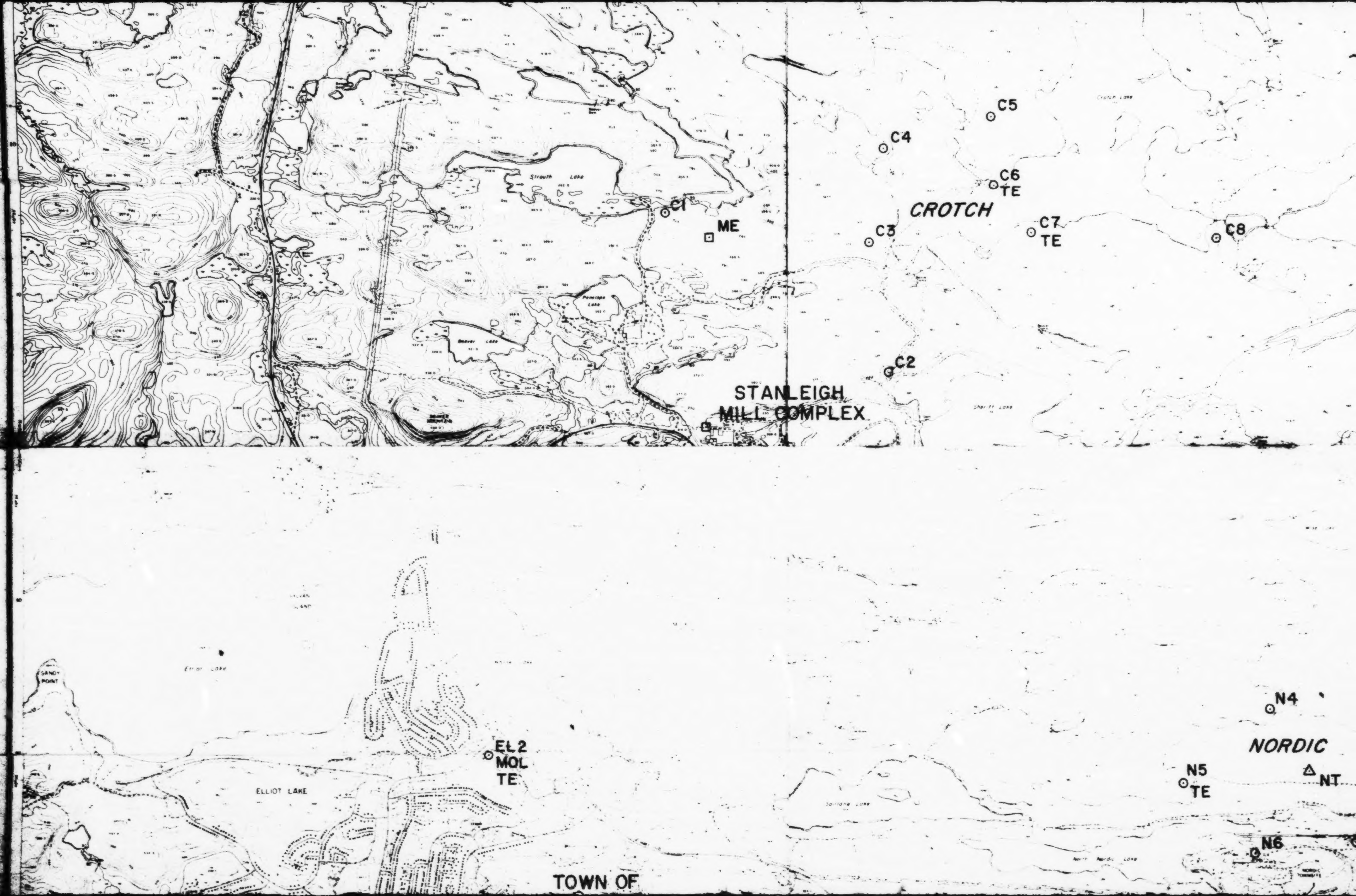

ME
ME
ME
ME
ME
ME
ME
DENISON
MILL COMPLEX
D3
D4
D5
D6
D7
PANEL
MILL COMPLEX
Quirke Lake
ROMAN ISLAND
ME
ME
ROOSTER
ROCK
ME
S7
S6
S9
S8
TE
STANROCK
S5
TE
S10
TE
S4
Teasdale Lake
Ouellette Lake

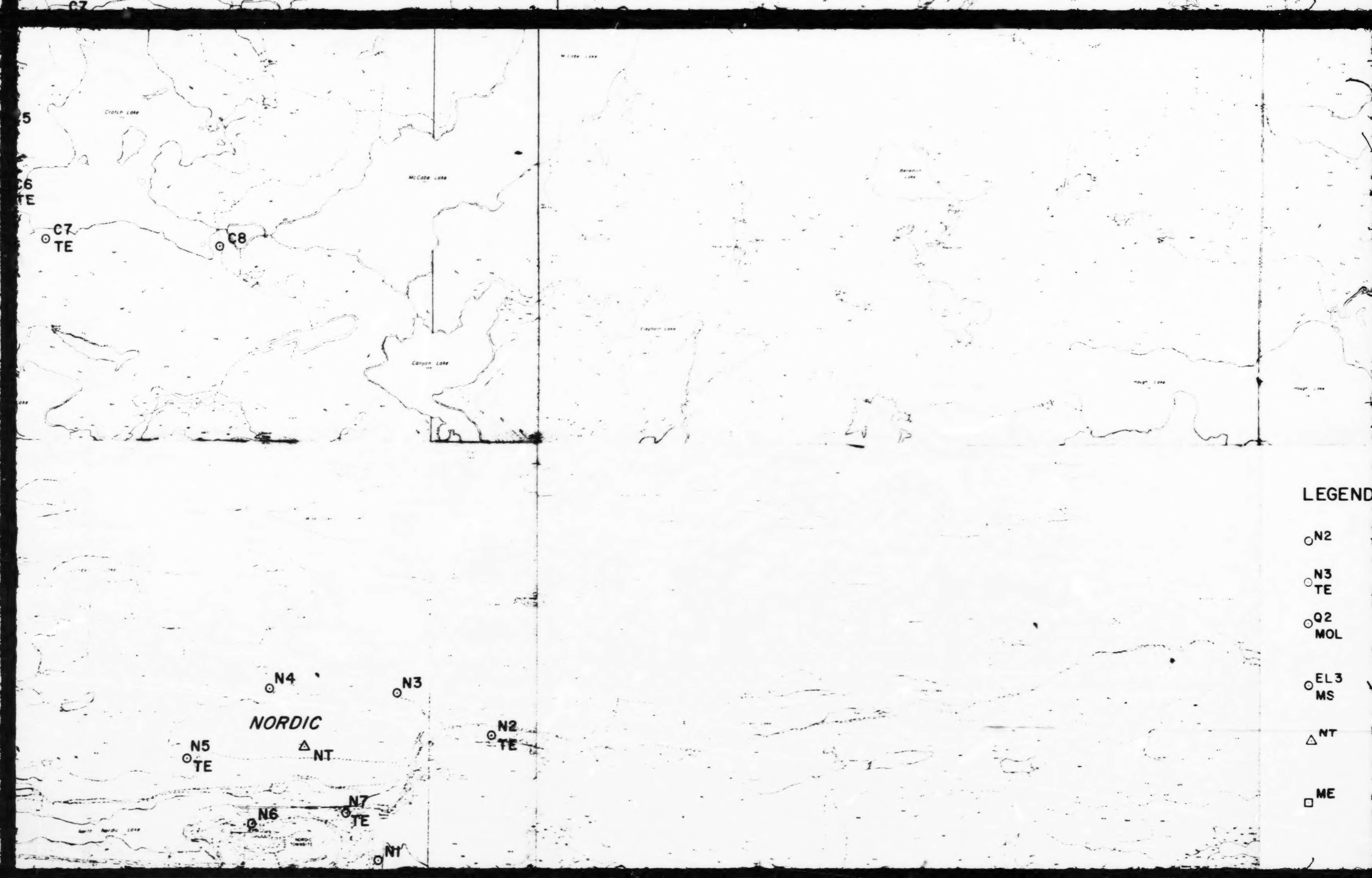
PANEL
COMPLEX
Quirke Lake
ME
ME
CONECHO POINT
Quirke Lake
Teasdale Lake
Teasdale Lake
Arrowhead Lake
Alta Lake
Nook Lake
S7
S6
S5
TE
STANROCK
Ouellette Lake
Ouellette Lake
Caribou Lake
S10
TE
S4

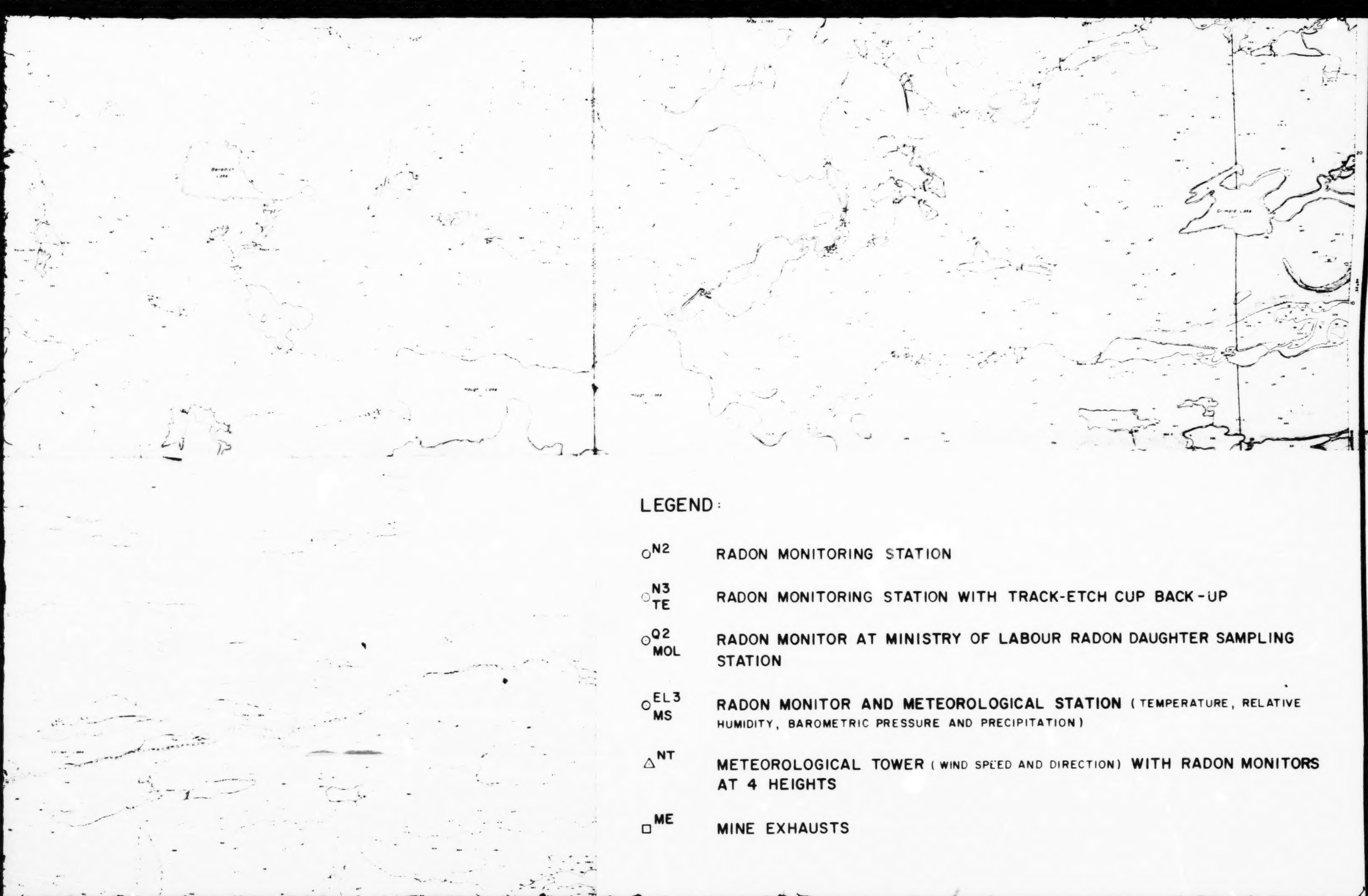

Flag Lake
D9
Gander Lake
D7
Mellon Lake
Rye Lake
D8
Beaver Lake
Crotch Lake
C5
C4
C6
TE
Strouth Lake
C1
ME
CROTCH
C3
C7
C8


D7
S9
S8
TE
STANROCK
S5
TE
Ouellette Lake
S10
TE
S4
Halfmoon Lake
D8
Quirke Lake
S2
S3
S1
Little May Lake
May Lake
May Lake
McCabe Lake
C5
Crotch Lake
McCabe Lake
Benedict Lake
C6
TE
C7


STANROCK
S5
TE
S10
TE
S4
S2
S3
Ouellette Lake
Ouellette Lake
Halfmoon Lake
Caribou Lake
Lizotte Lake
Lizotte Lake
Little May Lake
May Lake
May Lake
May Lake
May Lake
Corner Lake
Benedict Lake


C5
C4
C6
TE
CROTCH
C1
ME
C3
C7
TE
C8
C2
STANLEIGH
MILL COMPLEX
Strouth Lake
Crotch Lake
Beaver Lake
Sheriff Lake
SANDY POINT
Elliot Lake
EL2
MOL
TE
ELLIOT LAKE
TOWN OF
N4
NORDIC
N5
TE
NT
N6
Spillane Lake
North Nordic Lake


Crotch Lake
McCabe Lake
Canyon Lake
Elephant Lake
Hough Lake
C6
TE
C7
TE
C8
N4
N3
NORDIC
N2
TE
N5
TE
NT
N7
TE
N6
N1
LEGEND
N2
N3
TE
Q2
MOL
EL3
MS
NT
ME


Benedict Lake
Grimard Lake
Hough Lake
Hough Lake
May Lake

LEGEND:

○N2 RADON MONITORING STATION

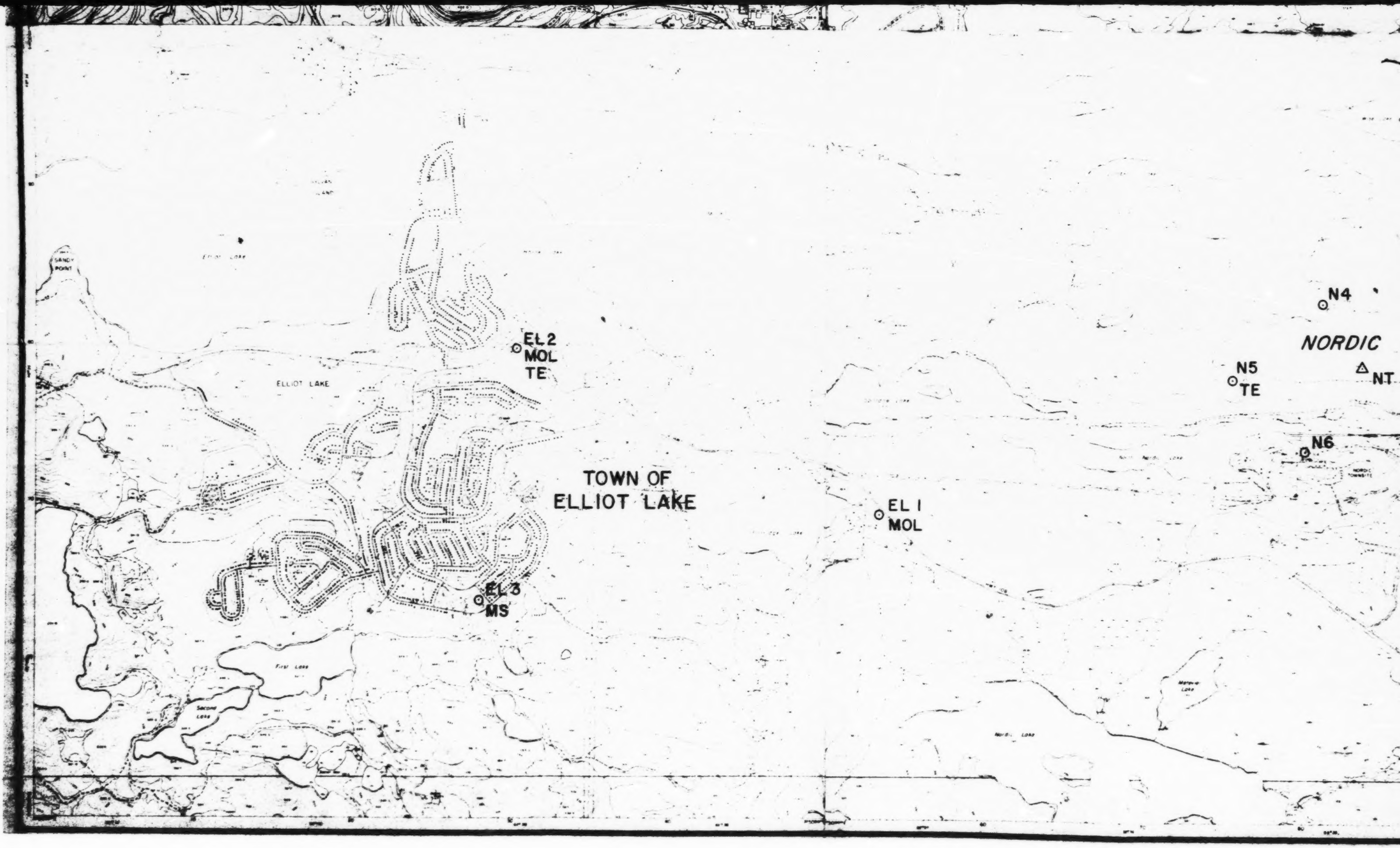
○N3 TE RADON MONITORING STATION WITH TRACK-ETCH CUP BACK-UP

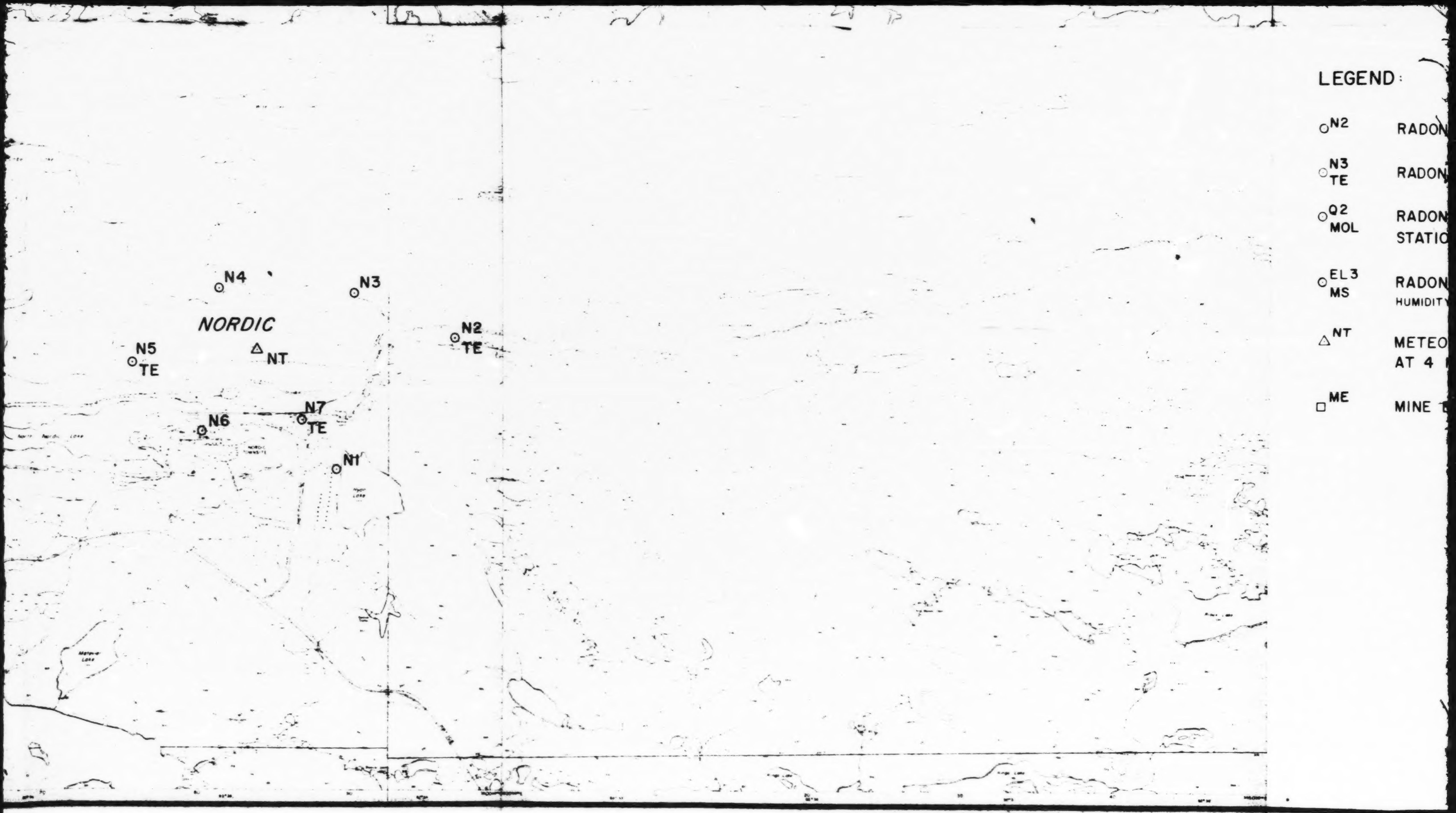
○Q2 MOL RADON MONITOR AT MINISTRY OF LABOUR RADON DAUGHTER SAMPLING STATION

○EL3 MS RADON MONITOR AND METEOROLOGICAL STATION (TEMPERATURE, RELATIVE HUMIDITY, BAROMETRIC PRESSURE AND PRECIPITATION)

△NT METEOROLOGICAL TOWER (WIND SPEED AND DIRECTION) WITH RADON MONITORS AT 4 HEIGHTS

□ME MINE EXHAUSTS


SANDY POINT
ELLIOT LAKE
EL2
MOL
TE
TOWN OF
ELLIOT LAKE
EL 3
MS
EL 1
MOL
First Lake
Second Lake
Nordic Lake
N4
NORDIC
N5
TE
NT
N6
NORDIC TOWNSITE


NORDIC
N1
N2
TE
N3
N4
N5
TE
N6
N7
TE
NT
LEGEND:
N2 RADON
N3 TE RADON
Q2 MOL RADON STATIO
EL3 MS RADON HUMIDITY
NT METEO AT 4
ME MINE

LEGEND:

○N2	RADON MONITORING STATION
○N3 TE	RADON MONITORING STATION WITH TRACK-ETCH CUP BACK-UP
○Q2 MOL	RADON MONITOR AT MINISTRY OF LABOUR RADON DAUGHTER SAMPLING STATION
○EL3 MS	RADON MONITOR AND METEOROLOGICAL STATION (TEMPERATURE, RELATIVE HUMIDITY, BAROMETRIC PRESSURE AND PRECIPITATION)
△NT	METEOROLOGICAL TOWER (WIND SPEED AND DIRECTION) WITH RADON MONITORS AT 4 HEIGHTS
□ME	MINE EXHAUSTS

0 1000m

SCALE 1 20000

FIGURE 3·1

LOCATION PLAN
OF RADON MONITORING NETWORK